Economic Valuation of Black-faced Spoonbill Conservation in Macao

Jin Jianjun

Revised Final Report Submitted to EEPSEA

December, 2007

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Background

Biological resources are an attractive and valuable resource for current and future generations, providing people with many important goods and services (OECD, 2002). However, poor conservation and management have resulted in significant degradation of the health and integrity of biological resources as well as the benefits derived by humans. Recent estimates suggest that 40-100 species become extinct worldwide each day (Chambers and Whitehead, 2003).

Wild biodiversity decline is of global policy concern (McNeely and Scherr, 2003) and economists have given increasing attention to it (Tisdell and Wilson, 2006). Many factors threaten wildlife; among them habitat conversion to other uses (such as urban development) and human (over)exploitation are the best known and most notorious (Bulte and Horan, 2003). The preservation of these animals requires that the individual species is protected and their habitats conserved. The costs of such conservation to society can generally be easily measured. To determine the economic efficiency of specific protection programs, it is necessary to compare these costs with some estimates of the economic benefits of preservation (Chambers and Whitehead, 2003).

However, estimating the non-market benefits from endangered species conservation is not easy since there is no market for the value of wildlife conservation. The contingent valuation method (CVM) (Mitchell and Carson, 1989) is the most widely used empirical method for measuring the non-market benefits of environmental goods, such as the preservation of wildlife species, as it can create hypothetical markets to elicit people's willingness to pay (WTP). An appealing aspect of CVM is that it can estimate the total economic value of any environmental amenity in question (Bandara and Clem, 2004). The economic valuation of protecting a specific species using CVM has received growing attention from academics, such as Loomis and Ekstrand (1998) on the Mexican spotted owl in the USA; White et al. (2001) on threatened mammals in Britain; Macmillan et al. (2002) on wild goose in UK; Giraud et al. (2002) on Steller sea lion in the USA; Chambers and Whitehead (2003) on wolves in Minnesota, USA; Bandara and Clem (2004) on Asian elephant in Colombo, Sri Lanka. Most of these studies, however, were done in developed countries. This current study estimates the benefits of conserving an endangered species in a developing country – the black-faced Spoonbill in Macao, China.

1.2 Statement of the Problem

The black-faced Spoonbill (*Platalea minor*) is a globally endangered species (IUCN, 2006) due to its small known world population, which can be found only on the east fringe of Asia (BirdLife International, 2000). Its known world population was only 1,206 in 2004 (Yu, 2004).

The black-faced Spoonbill is a relatively small wading bird with, as its name suggests, an elongated spoon-shaped bill. It is a migratory bird that breeds in the temperate region during summer. It migrates to subtropical and tropical regions in the south during autumn and winter, and returns to the northern breeding sites in early spring.

Its population is believed to continue to decline due to serious threats on their wintering and breeding grounds, including reclamation, coastal development, pollution, hunting and human disturbance (ICUN, 2006). Among these, habitat destruction due to the alteration and drainage of wetlands for aquaculture and industrial development is probably the biggest threat to the survival of the black-faced Spoonbill. Because a large proportion of the bird's population concentrates in a few places only during winter, the bird's susceptibility to these threats is heightened.

Macao is an important destination for black-faced Spoonbills' over-wintering; 50 such birds spent the 2003/2004 winter there. Macao, a Special Administrative Region (SAR) of China, is situated at the estuary where the Pearl River and the West River meet the sea. With many neighboring islands and rivers, the current speed of West River is relatively low, causing serious silting to occur at the coastal region of these islands. The mudflats associated with Macao's mangroves have different layers of deposits rich in organic matter, which attracts the black-faced Spoonbill to winter. The activities of the black-faced Spoonbill in Macao were first recorded in 1990. To protect this endangered species, the Macao SAR government declared the 45-ha area as the first ecological zone in 2001, which is used to provide good conditions for different migratory birds (including black-faced Spoonbills) in search of food and resting places and to protect other endangered species such as mangroves (Environment Council, 2002). Some ecologists estimate that if the black-faced Spoonbill's habitat can be properly conserved, there could be 127 black-faced Spoonbills in Macao by 2008 (Leung, 2003).

However, Macao is a small place, with a total area of about 27.3 km^2 only, composed of the Macao peninsula and the islands of Taipa and Coloane. Macao had a population of 448,495 people in 2003, with an average population density of about 16,428 inhabitants per km^2 (Statistics and Census Department, 2003). The annual gross domestic product (GDP) significantly increased from US$7,309 million in 1997 to US$11,574 million in 2005, which translates to a 58.35% growth in 8 years. With the rapid economic and tourism development in the past decades, land shortage has become a more serious problem than before. People tend to ignore the economic value of endangered species or biodiversity conservation, which can be gained by preserving the ecological zone in the long term. Some large-scale development or construction projects near or in the ecological zone may degrade the natural environment, resulting in the loss of economic benefits from endangered species conservation. Policymakers or planners concerned with endangered species conservation as a strategy for sustainable development may need to justify its economic benefits.

In view of the above, this study aims to measure the non-market benefits of black-faced Spoonbill conservation in Macao based on the local residents' preferences to help policymakers make better policies. This study can enrich the literature on the application of stated preference methods in developing countries for studying the household preferences and behaviors to reveal the value of the wildlife conservation.

1.3 Research Objectives

The general objective of this study is to estimate the economic benefits of black-faced Spoonbill conservation in Macao based on public preferences. The specific objectives are as follows:

1. To investigate the public's awareness, attitudes and behaviors regarding black-faced Spoonbill conservation in Macao;
2. To estimate the public's willingness to pay (WTP) for the conservation of black-faced Spoonbills in Macao;
3. To identify the factors that affect the WTP;
4. To determine the cost and benefits of a conservation program for black-faced Spoonbills in Macao, to recommend potential funding mechanisms;
5. To run an experiment on hypothetical and real WTP in Macao to validate the large scale CVM study.

2.0 THEORY AND METHODOLOGY

2.1 Total Economic Value

An endangered species conservation program can generate a wide variety of use and non-use values. The total economic values of the conservation can be grouped into several categories (Loomis and White, 1996): (a) *use value* such as sightseeings of the species; (b) *option value* to maintain genetic information provided by populations of the endangered species that may be useful for medicinal and genetic engineering applications in the future (Loomis, 1995); (c) *existence value* derived from the satisfaction of knowing that a particular species has a sustainable population in its native habitat (Freeman, 2003); (d) *bequest value*, which the current generation receives from knowing that preservation today would make this species available to the future generations. Collectively these benefits are referred to as the Total Economic Value (Randall and Stoll, 1983).

2.2 Non-market Valuation Techniques

This study aims to estimate the total benefits of endangered species conservation. However, estimating the non-market benefits from endangered species conservation is not easy, given the market failure associated with the public good. Consequently, economists have been addressing the questions concerning the economic value of non-market goods or services using different approaches. These may be divided into revealed and stated preference methods.

Revealed preference methods, also known as indirect methods, infer the value of associated non-market goods and services by studying actual (revealed) behaviors on an actually observed market. Typical examples of revealed preference methods are travel cost method (TCM) and hedonic price method (HPM) (Braden et al., 1991). Since the revealed preference methods require observable market data to make inferences about non-market values, it is hard to apply them to measure adequately the non-use or intangible values of endangered species conservation (Cooper, 1994; Stevens et al., 2000; Bateman, et al., 2002).

Stated preference methods, also known as direct methods, assess the value of non-market goods and services by using individuals' stated behaviors in a hypothetical setting. The most widely used stated preference methods is the contingent valuation method (CVM). This study is interested in assessing the value of endangered species

conservation to the public, measured in terms of whether people would be willing to pay for the endangered species conservation. CVM was used to quantify public preferences and WTP for endangered species conservation. The summary and meta-analysis of CVM studies of Loomis and White (1996) suggest that the CVM can provide meaningful estimates of the benefits of preserving endangered species, which can be used in policy planning.

2.3 Contingent Valuation Method

The contingent valuation method (CVM) (Mitchell and Carson, 1989) is a survey approach that involves developing a hypothetical market or referendum, which an individual uses to reveal or state his or her WTP for the protection of a specific species in a particular location (Loomis and White, 1996). It was originally proposed by Ciriacy-Wantrup in 1947; however, Davis (1963) was the first to use the CVM empirically when he estimated the benefits of goose hunting through a survey among goose hunters. This method gained popularity because it is the only approach that estimates the total economic benefits of environment amenity for both the users and nonusers (Amirnejad et al., 2005). Over the past two decades, the use of CVM for measuring WTP for social projects has been well accepted and widely used in many different circumstances in developing countries (Tapvong and Kruavan, 1999).

For this CVM study, the dichotomous choice method, which seeks simple 'yes' or 'no' answers to an offered bid, is used. The dichotomous choice method is preferred to other methods (e.g., open-ended method) because it is easier for respondents to react to the questions; households could respond keeping some budget constraint in view (i.e., the upper bounds on bids could be controlled); and it minimizes any incentive to strategically over-state or under-state WTP (Loomis, 1988; Moran, 1994; Ninan and Sathyapalan, 2005).

The standard dichotomous choice method is based on Hanemann's (1984) Random Utility Maximization (RUM) model. With RUM, economic agents are asked to provide 'yes' or 'no' responses to a question, whether they would be willing to pay a certain amount of money *A* for a policy alternative to improve the environment. The CVM therefore asks respondents to choose between status quo with utility:

$$U(q^0) = V(Y, q^0, s) + \varepsilon_0 \qquad (1)$$

and an alternative with utility:

$$U(q^1) = V(Y - A, q^1, s) + \varepsilon_1 \qquad (2)$$

where $U(\cdot)$ and $V(\cdot)$ are the respondent's direct and indirect utility function, respectively. Y is his or her income, q^0 is the current state of the environment, q^1 is the improved state of the environment and s is a vector of the socioeconomic characteristics of the individual (age, education, income, etc.). When faced with a bid, A, for a proposed change in the environmental good ($q^0 \rightarrow q^1$), the individual will accept the bid if

$$U(q^1) \geq U(q^0) \qquad (3)$$

that is, $V(Y - A, q^1, s) + \varepsilon_1 \geq V(Y, q^0, s) + \varepsilon_0$

where ε_0 and ε_1 are identically and independently distributed (i.i.d.) random variables with zero means. This equation can then be restated in terms of a probability. The probability of individual *i* choosing the alternative with costs *A* and environmental quality q^1 is the probability of obtaining a *Yes*-answer from person *i*, which is given by:

$$P_i\ (yes) = P_i[V_{i1}(Y - A, q^1, s) + \varepsilon_{i1} \geq V_{io}(Y, q^0, s) + \varepsilon_{i0}]$$

$$= P_i(\Delta V \geq \Delta\varepsilon) = F_\varepsilon(\Delta V) \qquad (4)$$

where $\Delta V = V_{i1}(Y - A, q^1, s) - V_{i0}(Y, q^0, s)$; $\Delta\varepsilon = \varepsilon_{i0} - \varepsilon_{i1}$; $F_\varepsilon(\Delta V)$ represents the cumulative density function (cdf) of the respondent's true maximum WTP.

2.3.1 Parametric estimation of WTP

The dichotomous choice CVM has a binary choice dependent variable that requires a qualitative choice model. The probit and logit models are commonly used models relating 'yes' or 'no' responses to relevant socioeconomic and other variables (Ninan and Sathyapalan, 2005). This study preferred to use the logit model because it is relatively simple to compute (Lee, 1997). The probability that the individual will accept an offer A can be expressed as the following logit model (Hanemann, et al., 1991):

$$P_i(yes) = F_\varepsilon(\Delta V) = \frac{1}{1 + \exp(-\Delta V)} = \frac{1}{1 + \exp[-(\alpha + \beta A)]} \qquad (5)$$

where α and β are coefficients to be estimated and *A* is the dollar amount the respondent was asked to pay. At a minimum, the coefficients include the bid amount the individual is asked to pay. Additional coefficients may include responses to attitude questions or the respondent's demographic information such as age, education, income, etc. (Giraud, et al., 2002).

The logit model above is then estimated using the maximum likelihood estimation method, which is the most common technique for estimating the logit model (Lee, 1997). The log-likelihood function is

$$\log L = \sum_{k=1}^{N} I_k \ln F_\varepsilon(\Delta V_k) + (1 - I_k)\ln(1 - F_\varepsilon(\Delta V_k)) \qquad (6)$$

where I_k is an indicator variable for observation *k*. If the answer is *yes*, I_k =1; otherwise, I_k =0.

The mean WTP can be determined using the formula[1]:

$$\text{MeanWTP} = -\frac{\alpha}{\beta} \qquad (7)$$

[1] The formula corresponds to the unrestricted mean WTP, implying that mean WTP can assume positive and negative values. Since it is possible that individuals would rather maintain the current situation, the possibility of negative WTP measures in the CVM exists and the unrestricted mean WTP is appropriate. The median is not calculated separately because if the utility function is linear in parameters, as in this study, then the mean and the median of the distribution of WTP coincide (Hanneman, 1989).

where β is the coefficient estimate on the bid amount and α is either the estimated constant (if no other independent variables are included) or the grand constant, calculated as the sum of the estimated constant plus the product of the coefficient estimates on other independent variables and times their respective means (Giraud, et al., 2002).

2.3.2 Non-parametric estimation of WTP

Non-parametric estimation techniques for the discrete choice valuation format are receiving increasing interest because of the concern associated with incorrect specifications of functional forms and distributions in parametric estimation approaches (Cooper, 2002). In addition, there is greater confidence in using parametric results if they could be validated through non-parametric techniques (Salazar and Marques, 2005). With this intention, a non-parametric approach is also applied in this study to obtain the mean WTP (Bateman et al., 2002).

Let N denote the total number of households in the sample, B_j is the bid levels ($j=1,2,\ldots J$). Each bid level is presented to a number of households who indicate whether or not they are willing to pay this amount. The sub-sample facing bid level B_j is denoted by N_j. The number of households replying 'yes' they are willing to pay amount B_j are those that have a higher WTP than B_i amount. Again this amount shall be denoted as n_j. Then the survivor function at each of the B_j can be calculated as:

$$\hat{S}(B_j) = \frac{n_j}{N_j} \quad (j=0 \text{ to } J) \tag{8}$$

The study assumes that if a zero bid level (B_0) was presented to a sample of respondents they would all be willing to pay this amount, that's, $\hat{S}(B_0) = 1$. Then the mean WTP can be calculated as (Bateman, et al., 2002):

$$\text{MeanWTP} = \sum_{j=1}^{J} \hat{S}(B_j)[B_j - B_{j-1}] \tag{9}$$

The median WTP can be calculated at the point where the survivor function evaluates to 0.5.

2.4 Survey Design and Implementation

2.4.1 Questionnaire design

Secondary data collection

Prior to undertaking focus group discussions, the study gathered background material/information and opinions on the current situation of the black-faced Spoonbill such as on its habitats, world population number, distribution and current recovery efforts. This was done by searching published reports and academic papers, as well as interviewing the Macao SAR government's Civic & Municipal Affairs Branch, Statistic and Census Service, and Environmental Council. Based on the gathered information, maps and worksheets were put together for use with focus group discussions.

Focus group discussions

In March 2005, six focus group discussions (FGDs) were conducted among the agencies involved in ecological zone management in Macao SAR government (i.e., Civic & Municipal Affairs Branch and Environmental Council), some environmental and biological experts (one representing environmental experts and the other, biological experts) as well as some local residents (two groups). Twenty-four persons participated in the FGDs, with four persons in each group. The FGD is a planned discussion guided by a facilitator, held in a neutral, non-threatening environment. The participants were encouraged to share their opinions with others. These focus groups provided insight as to how to structure the information within the survey. They also suggested types of information people desired.

Pre-test surveys

Following the FGDs, the draft questionnaire was pre-tested in April, 2005. Based on the results, the draft questionnaire was revised and a second pre-test survey was conducted on a sample of 120 respondents randomly distributed in 6 districts in Macao in September 2005.

This second pre-test survey served a number of objectives:

- to identify problems in the wording of the questionnaire and the formats used for answering each of the questions.
- to test whether the respondents could understand the WTP questions and the payment vehicle as well as the hypothetical time preference questions.
- to identify the range of WTP values, which could then be used to set the threshold values for the final 'dichotomous choice' version of the survey.
- to collect additional information on the people's knowledge and attitudes toward the black-faced spoonblill conservation.

Some of the important results obtained from the pre-testing were:

- The questionnaire was a bit long and the language had to be changed to make the questionnaire more understandable.
- The initial bid levels had to be changed. Both the highest bid (MOP200 per household per month) and the lowest bid (MOP5 per household per month) had to be decreased because the payment vehicle used was a surcharge on household monthly water bill and the average household monthly water bill was about MOP100-200.
- The hypothetical time preference questions were too complicated for the respondents to understand. The majority of the respondents would not like to spend more time in thinking carefully about their answers. Thus, these questions were dropped.

By and large, the pre-test worked well, and the information collected was used to refine the survey instrument, which was subsequently thoroughly revised and simplified. The final amounts used as bid levels were defined with reference to the responses to the pre-test bid amounts.

Survey instrument

The final questionnaire used was based on literature review, the FGDs, and some feedbacks from the two pre-test surveys. The questionnaire was composed of four sections (see Appendix A):

Section 1: General questions on the knowledge and priorities of the public about the problems faced by the government.

Section 2: Attitudinal and knowledge questions on endangered species conservation and some general questions on the black-faced Spoonbill.

Section 3: A conservation plan for black-faced Spoonbill protection in Macao, the payment method and some debriefing questions.

Section 4: Some socioeconomic questions on the respondents.

In the first section, the respondents were first asked about their opinions on the biggest problem facing the government given six choices. Then they were asked one question on their opinion about the environmental conservation situation in Macao. They were also asked to cite the three most important environmental problems in Macao given seven choices plus 'others'.

In the second section, the respondents were first asked about their perceptions of the relative importance given to specific endangered species conservation in Macao. They were then asked about their attitudes and opinions on ten statements about endangered species conservation, using a five-point Likert scale (ranging from strongly agree to strongly disagree). Finally, three questions on the recipients' knowledge of the black-faced Spoonbill were asked.

The third section focused on valuation questions. The respondents were first provided a brief description of the black-faced Spoonbill. Then the number, distribution and vulnerability to extinction of the bird were presented, accompanied by visual aids to facilitate a fuller understanding of the valuation scenario. The respondents were told that Macao was an important over-wintering destination for black-faced Spoonbills. However, the life of black-faced Spoonbills in Macao is serious threatened by human disturbance. Then the respondents were presented with an alternative conservation program designed to address these issues. The respondents were told that if this conservation program could be successfully implemented, it would contribute to the protection of black-faced Spoonbills in Macao. The black-faced Spoonbill population in Macao would be 127 after 2008 (Leung, 2003), which could help conserve the natural environment in Macao and protect the well-being of our future generations. The respondents were then told that funds are needed to implement the proposed conservation program and that the general public's support would be needed to establish a 'trust fund'. The fund could then request international organizations to provide counterpart funding, or additional contributions. The money raised by the fund would be used only for black-faced Spoonbill conservation activities in Macao as mentioned earlier.

The study used two payment vehicles with a split sample design. One is a voluntary surcharge on a household's water bill every month for the next five years. The other is a mandatory surcharge on a household's water bill every month for the next five years. Some arguments can be found in the literature on whether the voluntary contribution mechanism or mandatory payment vehicle should be used in developing countries. A number of recent CVM studies, for example, Champ et al (1997) and Chilton and Hutchinson (1999), have used the voluntary contribution mechanism to motivate respondents to tell the truth. However, Berrens et al. (2002) argues that the application of voluntary contribution mechanisms in the absence of a coercive provision rule could create both free-riding and warm-glow giving situations. Recognizing that such an approach fails the test of incentive compatibility, more recent CV research uses mandatory payment vehicles. Though it solves the problem of free-riding, however, it has several disadvantages. For example, some respondents may resist the idea of being forced to pay while others may not want to impose cost on those who would not have contributed voluntarily (Champ et al., 1997). However, empirical work that explores the differences between voluntary and mandatory WTP is still limited (Ryan, 2007). This current study addresses this issue by using a dichotomous choice elicitation and split sample design in the field to evaluate the possible effects of the two possible payment vehicles (voluntary or mandatory) on respondents' preferences for an endangered species conservation.

To make clean comparisons across CV scenarios, identical formats and questions were used, varying only in payment vehicle (voluntary and mandatory). In both cases, the respondents were told that the amount was fixed and would not change with the volume of water used. The hypothetical payment was limited to five years to make the payment more tangible than would a longer or indefinite payment duration.

The elicitation method chosen is a dichotomous choice question. This format was initially proposed by Hanemann et al. (1991). FAO (2000) reports that, in the recent past, this method has become a widely used elicitation format, particularly in developing countries. Based on the results of the focus groups and pre-test surveys, five different bids were established: MOP1, 5, 10, 20, 40. Within each of the two independent samples, each respondent was presented with a single randomly assigned dollar amount of these five payment levels and asked to respond with a simple 'yes' or 'no' to paying for the program.

If the answer was 'yes' to the WTP question, the respondents were asked to give reasons for their choice. A follow-up question asked the respondents how certain they were about really contributing that amount if given an actual situation to do so, using a 5-point Likert's scale (1 = very uncertain, 5 = very certain). Blumenschein et al. (2001) argue that the follow-up certain question could reduce the hypothetical bias of dichotomous choice contingent valuation method. Respondents who said they were not willing to pay the specified premium were asked on their reasons. This question can be used to identify the protest and valid zero answers. These respondents were further asked if they would be willing to pay any amount even though they were unwilling to pay the specified amount. This indicates whether or not they hold any economic value for the conservation program.

Prior to the WTP questions, a cheap talk script was included to reduce hypothetical bias. People were reminded of their limited budget and that any payment to support this program would necessarily mean that they had less money available to contribute to other issues or to buy things. The WTP questions were followed by some 'debriefing questions'. The respondents were asked whether they believed that the implementation of the black-faced Spoonbill conservation program would contribute to the conservation of black-faced Spoonbills in Macao. Their opinions on the choice of the payment vehicle were also debriefed.

The final section of the questionnaire contained background questions on the respondent's gender, age, education, income, occupation and household size. The questionnaires were given in the local language (Traditional Chinese).

2.4.2 Sample design

This study intends to obtain WTP information from the citizens in Macao. To get a randomly drawn sample of the Macao population, the researcher got assistance from the Statistics and Census Department (SCD) of Macao SAR government. The SCD used a multi-stage stratified random sampling procedure to provide a sample size of 1200 households from a total of 149,000 households distributed in six districts.

The sample size for this household survey was 400, which was divided into two sub-samples (Table 1). The first sub-sample of 200 respondents was used for the mandatory payment vehicle and the second sub-sample of 200 respondents was used for the voluntary payment vehicle. For each sub-sample, five bids were used, with 40 respondents for each bid.

Table 1. Usable sample size for the final survey

	Mandatory payment	Voluntary contribution
Sample/bid	40	40
No. of bids	5	5
Sub-total	40×5=200	40×5=200
Total	400	

2.4.3 Enumerator training

The study's 12 enumerators were recruited from the University of Macau. Students who majored in education, were experienced and were in their senior years were preferred. The enumerators underwent a training course wherein a careful explanation of all questions and tips on how to obtain cooperation from respondents were given.

2.4.4 Survey methods

As recommended by NOAA report (NOAA, 1993), CVM is conventionally applied through in-person interviews carried out by professionally trained staff. Typically, this can involve anywhere between 100 and 1000 interviews, each one lasting between 10 and 30 minutes. However, for decisions involving unfamiliar and/or complex environmental policies, especially where non-use values are being sought such as black-faced Spoonbill conservation in this study, personal interviews would appear to face

some potentially serious limitations (Macmillan, et al., 2002). A relatively new survey method in developing countries called drop-off is used to estimate the respondents' preferences. This survey method differs from personal interviews in that the respondents are given more time to consider their preferences and to discuss their WTP question with other household members.

An official letter using the University of Macau's letterhead and signed by the researcher was posted to the 1200 randomly selected households, requesting their assistance and cooperation on September 23, 2005, one week before the main survey started.

For the field survey, the enumerator would approach the randomly selected household and ask whether they would agree to participate in the survey. If they agree, the enumerator would leave the questionnaire and explain that only the household head could be the respondent. The household head was identified as the person in charge of the daily expenditures and other (younger) family members. After one to three days, depending on the commitment made by the respondent, the enumerator would come back and collect the questionnaire. Before leaving the house, the enumerator would assess and make sure that the questionnaire had been completely filled out. If necessary, he or she may conduct a follow-up personal interview.

3.0 EMPIRICAL RESULTS AND ANALYSIS

3.1 General Information

The final survey was conducted from the 30th of September through the 17th of October 2005. Among the 1200 households, 240 were not available because there was no one in the house or the house was being rented out to persons who were not Macao citizens or the persons were not the target respondents. Of the 1060 households approached, 430 households agreed to answer the questionnaire. The response rate was 35.83%. After assessing for missing and inconsistent answers to the valuation questions, the researcher obtained a sample of 400 useable observations for further analysis. Among these valid questionnaires, 200 respondents were asked their WTP for the black-faced Spoonbill conservation plan using the voluntary payment vehicle, and the other 200 were asked their WTP using the mandatory payment vehicle.

3.1.1 Socioeconomic characteristics of the respondents

Table 2 shows the descriptive statistics of the main socioeconomic characteristics of the sample. To check the non-response bias, the researcher compared the demographic and socioeconomic characteristics of the survey respondents with the Macao census data on the characteristics of the Macao population as a whole. The survey data were found to be close to the Macao average.

Table 2. Main socioeconomic characteristics of the respondents

		Sample average		Macao
Variable	Description	Mean	Std. dev.	average [a]
AGE	Age	35.33	12.64	-
GENDER	1 = male, 0 = female	0.54	0.50	0.48

CIVSTAT	1= married, 0 = unmarried	0.60	0.49	-
EDUC	Education of respondents (1= No formal schooling, 2= Elementary, 3= High school,4= College,5= Master's or above)	3.28	0.76	-
NP	Number of household members living together	3.54	1.33	3.18
NP15	Number of household members less than 15 years old	0.62	0.83	0.51
INCOME	Total household income (MOP/month)	15908	14252	15304

[a] Statistics and Census Department (2003).

The mean age of the respondents was 35.33 years. Fifty-four percent of them were male and about 60% were married. The average educational level was between high school and college. Specifically, 47.50% had finished high school and 36% had finished college education. The mean household size was around 3-4 persons, with a mean of less than one person under 15 years of age. The average household income was around MOP15,908/month (US$1,988/month).

Table 3 reports the main socioeconomic characteristics of the respondents according to the payment vehicle. The mean age of the respondents in the voluntary payment vehicle (35.04 years) is similar to that in the mandatory payment vehicle (35.63). In both cases, there were more males than females. The education level of the respondents in the voluntary payment vehicle was higher than that in the mandatory payment vehicle, but the difference is not significant. The mean household size for both groups was 3-4 people. Forty-two percent of the voluntary payment households and forty-seven percent in the mandatory payment households had children under 15 years of age. The average household income was around MOP15,304/month (US$1,913/month) and MOP16,513/month (US$2,064/month) for the respondents in the voluntary payment vehicle and in the mandatory payment vehicle, respectively. A two-sample t-test for differences in means of the socioeconomic variables of the two groups shows no statistical differences. Therefore, one can assume that any differences in WTP levels across the two survey versions are related to treatment effects, and not due to demographic or socioeconomic characteristics.

Table 3. Main socioeconomic characteristics of the sample, voluntary vs. mandatory payment vehicle

Variable	Voluntary (n=200)		Mandatory (n=200)		t-statistics
	Mean	Std. Dev.	Mean	Std. Dev.	
AGE	35.04	12.57	35.63	12.71	-0.4475
GENDER	0.55	0.50	0.54	0.50	0.3004
CIVSTAT	0.58	0.50	0.63	0.48	-1.0874
EDUC	3.32	0.76	3.24	0.75	1.1146
PEOPLE	3.53	1.37	3.55	1.29	-0.1504
NP15	0.57	0.82	0.68	0.84	-1.2311
INCOME	15304	10910	16513	16971	-0.8680

3.1.2 Attitudes toward the general problems faced by the government

Almost half (46.08%) of the respondents indicated social problems as the biggest problem faced by the government, followed by economic problems and environment (Table 4).

Table 4 Respondents' opinions on the biggest problem faced by the government

Problem	Number of respondents	Percentage	Importance rank
Economic problems	90	22.06%	2
Social problems	188	46.08%	1
Infrastructure	58	14.22%	4
Environment	64	15.69%	3
Terrorism	2	0.49%	6
Others	6	1.47%	5

The majority of the respondents (74.5%) thought that the environment and natural resources in Macao were not properly taken care of.

In terms of the three most important issues related to nature and human impact on the natural environment, the respondents did not give much weight to endangered species conservation (Tables 5-7). Only 4.75% of them considered endangered species conservation as the most important environmental problem in Macao and only 5.75% ranked it as the second most important environmental problem. The respondents gave greater importance to air pollution, water pollution, solid waste management, enhanced greenhouse effect and traffic noise problems.

Table 5. Respondents' most important environmental problem in Macao

Problem	Number of respondents	Percentage	Importance rank
Air pollution	178	44.50%	1
Water pollution	55	13.75%	3
Solid waste management	39	9.75%	4
Endangered species conservation	19	4.75%	6
Deforestation	19	4.75%	6
Traffic noise/problems	31	7.75%	5
Enhanced greenhouse effect	56	14.00%	2
Others	3	0.75%	8

Table 6. Respondents' second most important environmental problem in Macao

Problem	Number of respondents	Percentage	Importance rank
Air pollution	78	19.50%	2
Water pollution	91	22.75%	1
Solid waste management	73	18.25%	3
Endangered species conservation	23	5.75%	7
Deforestation	34	8.50%	6
Traffic noise/problems	56	14.00%	4
Enhanced greenhouse effect	41	10.25%	5
Others	4	1.00%	8

Table 7. Respondents' third most important environmental problem in Macao

Problem	Number of respondents	Percentage	Importance rank
Air pollution	56	14.00%	4
Water pollution	63	15.75%	3
Solid waste management	86	21.50%	1
Endangered species conservation	48	12.00%	6
Deforestation	24	6.00%	7
Traffic noise/problems	65	16.25%	2
Enhanced greenhouse effect	53	13.25%	5
Others	5	1.25%	8

3.1.3 Knowledge and attitudes toward endangered species conservation

The respondents were asked to choose one endangered species that is most deserving of protection from the four endangered species in Macao shown in questionnaire (Question 5 of the survey questionnaire, see Appendix A). The results show that the first priority was Chinese white dolphins, followed by mangrove, black-faced Spoonbills and white sea eagles.

To elicit the respondents' attitudes toward endangered species conservation, 10 statements were presented and the respondents were asked to state their opinions on a scale of 5 to 1, with 5 as 'strongly agree' and 1 as 'strongly disagree'.

As Table 8 shows, the majority (76.3%) strongly agreed or agreed that there are more important environmental concerns than endangered species conservation. This result is consistent with previous findings. More than three quarters (80.8%) of the respondents had existence values for the endangered species as they strongly agreed or agreed that "it is everyone's duty to ensure that plants and animals as we know them today will exist for mankind to enjoy in the future." Half (strongly) agreed that citizens should contribute to endangered species conservation by making cash donations to this cause. The majority had altruism values for endangered species as they strongly agreed or agreed with the statement that "endangered species are important even if I don't get to see or interact with them."

Table 8. Attitudes of respondents toward endangered species conservation

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Question 1	89 (22.3%)[a]	234 (58.5%)	7 (1.75%)	33 (8.25%)	37 (9.25%)
Question 2	61 (15.3%)	244 (61.0%)	5 (1.25%)	35 (8.75%)	55 (13.75%)
Question 3	143 (35.8%)	202 (50.5%)	8 (2.00%)	21 (5.25%)	26 (6.50%)
Question 4	104 (26.0%)	219 (54.8%)	8 (2.00%)	31 (7.75%)	38 (9.50%)
Question 5	32 (8.0%)	169 (42.3%)	19 (4.75%)	56 (14.00%)	124 (31.00%)

Question 6	61 (15.3)	228 (57.0%)	9 (2.25%)	58 (14.50%)	44 (11.00%)
Question 7	18 (4.5%)	124 (31.0%)	49 (12.25%)	51 (12.75%)	158 (39.50%)
Question 8	91 (22.8%)	203 (50.8%)	7 (1.75%)	30 (7.50%)	69 (17.25%)
Question 9	78 (19.5%)	167 (41.8%)	14 (3.50%)	62 (15.50%)	79 (19.75%)
Question 10	39 (9.8%)	148 (37.0%)	18 (4.50%)	68 (17.00%)	127 (31.75%)

Question 1: The government should raise more funds to deal with environmental programs.
Question 2: There are more important environmental concerns than endangered species conservation.
Question 3: Poaching of wildlife species should be punishable by law.
Question 4: It is everyone's duty to ensure that plants and animals as we know them today will exist for mankind to enjoy in the future.
Question 5: Citizens should contribute to endangered species conservation by making cash donations to this cause.
Question 6: Endangered species are important even if I don't get to see or interact with them
Question 7: The government should raise taxes to pay for more endangered species protection.
Question 8: The government should invest in helping people before it spends money on endangered species.
Question 9: Households who earn more income should contribute more to endangered species conservation
Question 10: Endangered species conservation should be a priority concern of the government.
[a] Numbers in parentheses show percentage of response to different issues on endangered species conservation.

Three questions were posed to find out the respondents' knowledge of the black-faced Spoonbill. The survey results showed a substantial lack of previous knowledge of this endangered species. The majority (68.5%) of the respondents reported that they had not seen a live black-faced Spoonbill in wild. Only half of the respondents knew that the black-faced Spoonbill is a migratory bird. About 46.5% of the respondents agreed that some communities could benefit from black-faced Spoonbill conservation, such as through ecotourism. Only 51.25% of the respondents knew that the black-faced Spoonbill is an endangered species.

3.2 Benefit Estimation

3.2.1 Non-parametric estimation

Before doing the regression analysis, it is useful to look first at some non-parametric analyses of willingness to pay.

Entire sample

Table 9 shows the results obtained from the mandatory payment vehicle (PV) and the voluntary payment vehicle if all responses are included for analysis. As expected, the 'yes' response monotonically decreases (increases) as the offer amount goes up (down). This is always a key marker of the validity of a dichotomous choice survey (Blaine et al., 2005). In addition, the mandatory payment vehicle elicited higher WTP values at four bid levels than did voluntary payment vehicle.

Table 9. Proportion of "yes" responses and estimates of acceptance probability

Bid (MOP)	Entire sample	Voluntary Payment Vehicle	Mandatory Payment Vehicle

	"Yes" responses (n=80)	Probability (%)	"Yes" responses (n=40)	Probability (%)	"Yes" responses (n=40)	Probability (%)
1	63	78.75	32	80.00	31	77.50
5	41	51.25	20	50.00	21	52.50
10	32	40.00	15	37.50	17	42.50
20	24	30.00	9	22.50	15	37.50
40	10	12.50	3	7.50	7	17.50

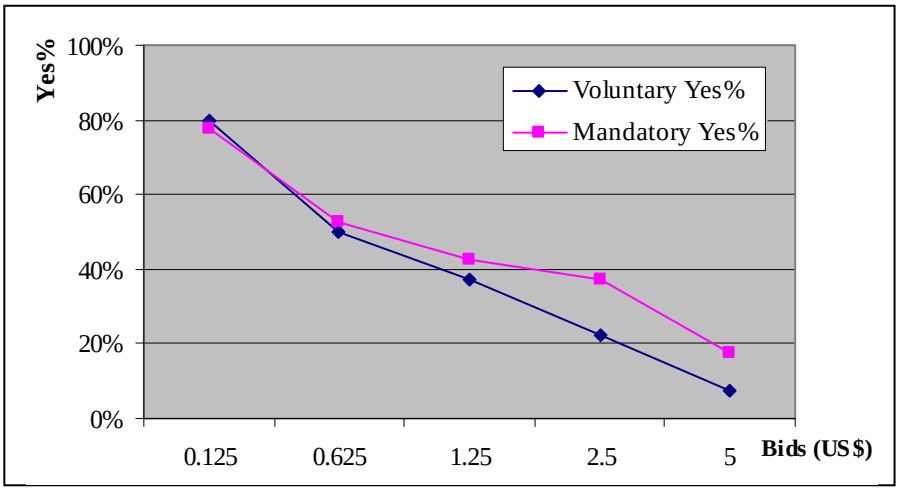

Figure 1. Bid curve of the voluntary and mandatory PV of the entire sample

Figure 1 illustrates the bid curve for both the voluntary payment vehicle and the mandatory payment vehicle data.

This study used the lower-bound estimation method (Bateman et al., 2002) to estimate the mean WTP since it provides a conservative value. Table 10 shows the mean WTP estimation results obtained from both the voluntary payment vehicle and the mandatory payment vehicle as well as their 95% confidence intervals.

Table 10. Mean WTP estimation results

	Mean WTP MOP (US$)	Standard error MOP (US$)	95% confidence interval MOP (US$)
Voluntary	8.43 (1.05)	0.64 (0.08)	7.18-9.68 (0.90-1.21)
Mandatory	12.25 (1.53)	1.09 (0.14)	10.11-14.39 (1.26-1.80)
Entire sample	10.34(1.29)	0.54(0.06)	9.27-11.41(1.16-1.43)

For the voluntary payment vehicle sample, the mean WTP is MOP8.43 (US$1.05) per household per month in 5 years as a surcharge on household water bill. For the mandatory payment vehicle sample, it is MOP12.25 (US$1.53).

From Table 10, it can be seen that the 95% confidence intervals of the mean WTP values from the voluntary payment vehicle and the mandatory payment vehicle do not overlap. It can be concluded that the mean WTP from the mandatory payment vehicle is significantly higher than that from the voluntary payment vehicle (Duffield and Patterson, 1991; Loomis, et al., 1997).

Adjustments for protest and uncertainty responses

Protest response

As is standard, a follow-up check question was asked after the WTP question for both voluntary and mandatory payment vehicle surveys to determine if those refusing to pay represent a valid representation of their valuation of the good or indicate a protest against some features of the simulated market. This check question has six response categories, plus a seventh category titled 'others'. The second and the sixth categories represent valid refusals or zeros and are considered non-protests, which are:

2. I cannot afford that amount of payment.

6. I think that other species are more important than black-faced Spoonbills.

The rest of the categories represent what are usually classified as protest or scenario rejection responses. These are:

1. I do not think that the conservation of black-faced Spoonbills is worth doing.

3. I do not believe the money that I will pay will actually be used for black-faced Spoonbill conservation.

4. I think it is the government's responsibility.

5. I do not believe paying money will achieve the target objective.

For the voluntary payment vehicle sample, a total of 121 respondents answered 'no' to the WTP question across all five bid amounts. Among them, 56 respondents voted 'no' to one of the non-protest categories, which indicate that they seriously took the commitment to pay. On the other hand, 65 respondents selected one of the protest categories.

Of the respondents in the mandatory payment vehicle, 109 voted 'no' to the referendum question across the five bid amounts. Among these zero WTP respondents, 46 respondents cited as reasons not being able to afford the amount of payment and considering other species as more important than the black-faced Spoonbill. They were considered as valid zero WTP. The other 63 answers were regarded as protest or scenario rejection responses.

Following what has been observed in the literature, , the protest responses in the censored sample were removed from the sample because they were considered as not indicative of the respondents' 'true' values.

Certainty

Respondents were asked how certain they were in making the payment if the proposed conservation program would be implemented. A five-point scale was used with 1 as "very uncertain'' and 5 as ''very certain." The majority indicated their certainty. Only one respondent (0.5%) in the voluntary sample and two respondents (1%) in the mandatory sample stated they were not certain about their answers to the WTP question. These unsure responses were adjusted, i.e., respondents who expressed degrees of uncertainty to the dichotomous choice WTP question were reclassified as "no" responses to the WTP question. This approach is similar to the method used by Champ et al. (1997).

Table 11 shows the bids and the resulting 'yes' responses for both the voluntary and mandatory payment vehicles after the protest responses were removed and uncertain responses were adjusted. The corresponding bid curves are shown in Figure 2.

Table 11 Bids and proportion of yes-answers for the censored sample

Bid (US$)	Voluntary PV			Mandatory PV		
	Total	Yes	Yes (%)	Total	Yes	Yes (%)
0.125	36	32	88.89	35	31	88.57
0.625	25	20	80.00	30	21	70.00
1.25	26	15	57.69	28	17	60.71
2.5	24	9	37.50	25	13	52.00
5	24	3	12.50	19	7	36.84
Total	135	79	58.52	137	89	64.96

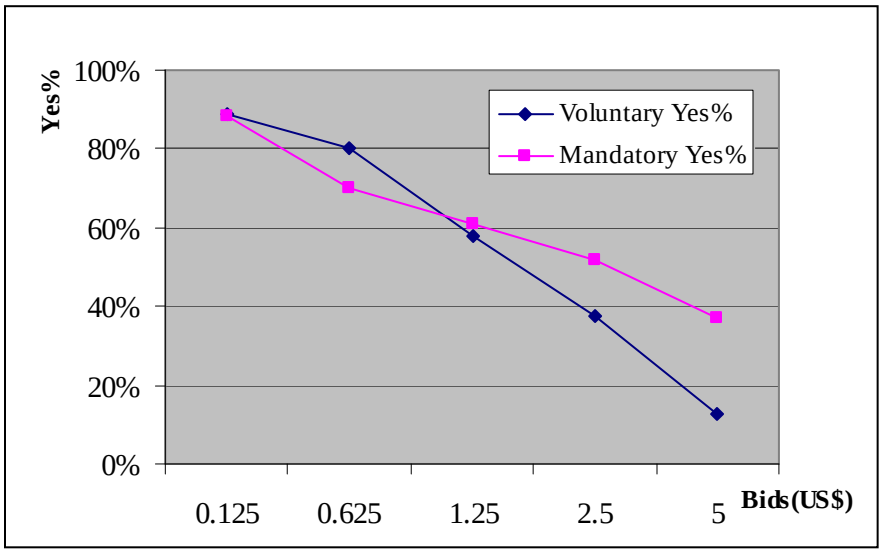

Figure 2. Bid curve of the censored sample

Table 12 shows the corresponding mean WTP estimation results obtained using the lower-bound estimation method on both the voluntary and mandatory payment vehicle data as well as their 95% confidence intervals.

Table 12. Mean WTP estimation results for the censored sample

PV	Mean WTP MOP (US$)	Variance MOP (US$)	95% CI MOP (US$)
Voluntary PV	13.22(1.65)	1.41(0.18)	10.46-15.98(1.31-2.00)
Mandatory PV	19.29(2.41)	1.39(0.17)	16.57-22.01(2.07-2.75)
Entire sample	16.26(2.03)	0.71(0.09)	14.86-17.66(1.86-2.21)

For the voluntary payment vehicle data, the mean WTP of the Macao residents for black-faced Spoonbill conservation is MOP13.22 (US$1.65) per household per month as a surcharge on household water bill in next 5 years. It is MOP19.29 (US$2.41) in the case of the mandatory payment vehicle data. As can be seen in Table 12, the 95% confidence intervals of the mean WTP values from both voluntary and mandatory payment vehicles do not overlap. This confirms that the mean WTP values from the two payment vehicles are significantly different.

3.2.2 Parametric estimation

The parametric estimation conducted in this study is the logit estimation of the linear utility function by maximum likelihood estimation method. The estimation analysis used the Econometrics Package Limdep Nlogit 3.0 (Greene, 2002).

Entire sample

Table 13 shows the estimation results from the voluntary payment vehicle, the mandatory payment vehicle and the pooled data (combining or pooling observations from both the voluntary payment vehicle and the mandatory payment vehicle responses). The regression results show that the coefficients of BID are all negative and significant at 1% level in the voluntary payment vehicle case, the mandatory payment vehicle case and the pooled data. This result was expected and indicates that the probability of saying 'yes' decreases with the increase of prices. This confirms the findings in the non-parametric estimation method with clear statistical significance.

Table 13. Logit estimation results using the entire sample

Parameter	Voluntary	Mandatory	Pooled
	Coeff. (S. E)	Coeff. (S. E)	Coeff. (S. E)
CONSTANT	0.79(0.24)***	0.67(0.22) ***	0.70(0.16) ***
BID	-0.10(0.18) ***	-0.06(0.01) ***	-0.07(0.01) ***
Mean WTP (MOP)	8.08	11.12	9.39
95% CI (MOP)	4.73-11.43	6.12-16.12	6.43-12.35
LL_U	-109.34	-123.95	-235.71
LL_R			-272.74
Pseudo R^2	0.19	0.10	0.14
Observations	200	200	400

Note: *** Significant at $p<0.01$. 95% confidential intervals were obtained by the so-called delta method (Greene, 2000).

The mean WTP from the voluntary payment vehicle data set is about MOP8.08 (US$1.01) per household per month as a surcharge on the household water bill in the coming 5 years, that from the mandatory payment vehicle is about MOP11.12 (US$1.39), and that from the pooled data is MOP9.39 (US$1.17).

Here, a likelihood ratio (LR) test was used to test if the mean WTP from the mandatory payment vehicle is different from the mean WTP from the voluntary payment vehicle. The null hypothesis of the LR test is: Bn (voluntary) = Bn (mandatory), where Bn (voluntary) and Bn (mandatory) are the coefficients in the logit equations for the voluntary payment vehicle data set and the mandatory payment vehicle data set, respectively. The LR test statistic is given by

$$\lambda_{LR} = -2[LL_R - (LL_{UM} + LL_{UV})]$$

where LL_R is the log likelihood of a single logit equation (i.e., the restricted model) estimated using the pooled data set; LL_{UM} is the log likelihood of the unrestricted model using the mandatory payment vehicle data set and LL_{UV} is the log likelihood of the unrestricted model estimated using the voluntary payment vehicle data set.

This statistical test follows a chi-square distribution, with degrees of freedom equal to the sum of the number of coefficients in the two unrestricted models minus the number of coefficients in the restricted model. It yielded a chi-square of 78.9, compared with the critical chi-square values with two degrees of freedom (in this case) at five percent and one percent significance levels, which are 5.99 and 9.21, respectively. The test statistic is larger than the critical values both at the five percent and one percent significance levels. Thus, the null hypothesis that the independent variables affect the dependent variable at the one percent significance level is rejected. The estimated mean WTP of the mandatory payment vehicle is significantly different from that of the voluntary payment vehicle.

To evaluate the variables influencing the respondents' responses, a logit model with some socioeconomic characteristics of the respondents was used. The dependent variable used was whether or not a person was willing to pay the amount asked during the survey. The independent vaiables are some perception and socioeconomic variables (Table 14). In the pooled model, a dummy "VOLUNT" variable was included, which indicates whether payment was voluntary or mandatory.

Table 14. Definitions of variables included in the logit models

Variable	Definition
BID	The bid used
PVSUIT	Dummy variable, 1 if the respondent thought the payment vehicle chosen was appropriate; 0 otherwise

PROTSPO	The respondent's belief on whether or not the conservation program could help save the black-faced Spoonbill, 1 = Believe, 2 = Average, 3 = Don't believe
AGE	Age of respondents
PEOPLE	Total number of household members
INCOME	Total household income (1000MOP/month)
PET	Dummy variable, 1 if have pets in household; 0 otherwise
MENVTO	Dummy variable, 1 if a member of any environmental organization; 0 otherwise
VOLUNT	Dummy variable, 1 if voluntary payment vehicle; 0 if mandatory payment vehicle

Table 15 shows the regression results and coefficient estimates with standard errors (in parenthesis) and probabilities (indicated by asterisks). The model estimation results show that the signs of the main variables (BID, INCOME and MENVTO) are consistent with expectations of the demand theory and that the goodness of fit, in terms of correct predictions and pseudo R^2 , was acceptable.

Table 15. Logit estimation results with socioeconomic variables included

Variable	Voluntary	Mandatory	Pooled
VOLUNT	-	-	-0.47(0.26)*
CONSTANT	-0.24(1.17)[a]	-0.40(1.03)	2.25(0.64)***
BID	-0.19(0.04)***	-0.07(0.02)***	-0.10(0.01)***
PVSUIT	2.05(0.55)***	2.65(0.45)***	-
PROTSPO	-0.29(0.35)	-0.55(0.27)**	-0.89(0.19)***
AGE	-0.03(0.02)	-0.02(0.02)	-0.02(0.01)**
PEOPLE	-0.27(0.19)	0.28(0.16)*	0.04(0.99)
INCOME	0.23(0.05)***	0.03(0.01)***	0.06(0.01)***
PET	0.93(0.57)*	1.76(0.55)***	1.22(0.33)***
MENVTO	2.76(1.20)**	2.67(1.43)*	1.65(0.85)*
LL_U	-61	-78	-183
LL_R	-134	-137	-270
Pseudo R^2	0.55	0.43	0.32
% Correct predictions	85.43%	80.9%	77.27%
Observations	199	199	398

[a] Numbers in parentheses are standard error. *** Significant at $p<0.01$, **Significant at $p<0.05$, *Significant at $p<0.1$.

As shown in each regression, the "BID" variable is negative and highly statistically significant; the probability of saying "yes" to the valuation questions clearly declines as bid levels increase. This also confirms the findings in the non-parametric estimation method with clear statistical significance.

As for the socioeconomic and perception variables, some consistent impacts are found. In particular, coefficients on INCOME are positive and significant at 1% level in all three regressions. This result supports the hypothesis that the probability of the respondent saying 'yes' to the WTP question increases with household income. The coefficients for MENVTO are positive and significant in three models. This is understandable because usually environmentalists are more concerned about environmental problems and they would like to pay more for the environmental goods than non-environmentalists. In the pooled model, the AGE variable is negative and significant, which means that the probability of a 'yes' responses decreases as the

respondent's age increases. Two possible explanations for this sign are that the older a person, the lower his/her expectations of future consumption of this public good, or it could be due to the different education and values of older people. Interestingly, the coefficients for PET are positive and significant, indicating that the household who likes animals would contribute more to the endangered species conservation. The coefficients of PROTSOP in the mandatory model and the pooled model are negative and significant as expected, indicating that if a respondent thought the conservation program would successfully contribute to the black-faced Spoonbill conservation in Macao, the probability of acceptance would be higher. The PVSUIT coefficients in both voluntary and mandatory models are positive and significant. This suggests that a respondent who thinks the payment vehicle used in the survey is appropriate would have a higher probability of answering 'yes' to the WTP question.

The regression results are also consistent with the qualitative findings presented earlier on the impacts of payment method. The dummy variable VOLUNT is negative and significant in the pooled model, which suggests that the voluntary payment vehicle has a significant and negative effect on the respondents' WTP. If the payment vehicle is mandatory, the respondents would have a higher probability of answering 'yes' to the WTP question.

Similarly, a LR test of the equality of the logit coefficient yielded a chi-square of 262, which is much greater than the critical chi-square values of 14.1 at the 0.05 significance level and 18.5 at the 0.01 level, with seven degrees of freedom. Thus, the null hypothesis is also rejected. It can be confirmed further that the mean WTP from the mandatory payment vehicle is significantly higher than that from the voluntary payment vehicle.

Based on the logit estimation results, the mean WTP values in the voluntary, mandatory and pooled models are MOP9.09 (US$1.14), MOP9.88 (US$1.25) and MOP9.51 (US$1.19), respectively, per household per month in the coming 5 years.

Censored sample

Table 16 shows the estimation results of logit analysis for the voluntary payment vehicle, the mandatory payment vehicle and the pooled data if the protest responses are excluded from the samples and the uncertain answers are adjusted.

Table 16. Logit estimation results using the entire sample

Parameter	Voluntary	Mandatory	Pooled
	Coeff. (S. E)	Coeff. (S. E)	Coeff. (S. E)
CONSTANT	1.67(0.31)***	1.34(0.28) ***	1.49(0.20) ***
BID	-0.10(0.02) ***	-0.05(0.01) ***	-0.08(0.01) ***
Mean WTP (MOP)	16.57	24.77	19.79

LL_U	-70	-81	-154
LL_R	-92	-89	-181
Pseudo R^2	0.23	0.08	0.15
% Correct predictions	76%	69%	72%
Observations	135	137	272

Note: *** Significant at $p<0.01$.

As expected, the BID coefficients for the three cases are negative and significant at 1% level. The mean WTP obtained from the censored sample is higher than that from the entire sample. The mean WTP values obtained from the voluntary payment vehicle, mandatory payment vehicle and pooled data are MOP16.57 (US$2.07), MOP24.77 (US$3.10), and MOP19.79 (US$2.47) per household per month in the coming 5 years, respectively.

Also a likelihood ratio was used to test the coefficient equality of the logit equations used to estimate WTP. The calculated value is 60, which is larger than the chi-square critical value of 5.99 at the 0.05 significance level and 9.21 at the 0.01 significance level with two degrees of freedom. The mean WTP from the mandatory payment vehicle is again significantly larger than that from the voluntary payment vehicle.

Table 17 presents the results for the voluntary payment vehicle and the mandatory payment vehicle as well as the pooled data if the socioeconomic variables are considered as independent variables in the WTP estimation.

The estimation results show that the censored data can significantly improve the goodness of fit of the models in terms of pseudo R^2 and percentage of correct predictions. The coefficients of BID are all negative and significant at 1% level in the three models, as expected. The coefficients of INCOME are also positive and significant, which is consistent with the economic theory. PET is positive and significant, which again supports the hypothesis that the household with a pet has a higher probability to say 'yes' to the WTP question on endangered species conservation. The dummy variable VOLUNT is negative and significant in the pooled model, which indicates that the mandatory payment vehicle can increase the probability of respondents saying 'yes' to the WTP question. The likelihood ratio also indicates that the mean WTP from the mandatory payment vehicle is significantly larger than that from the voluntary payment vehicle.

Based on the estimation results, the mean WTP values obtained from the voluntary data, the mandatory data and the pooled data are MOP18.03 (US$2.25), MOP38.56(US$4.82) and MOP25.13(US$3.14) per household per month in the coming 5 years, respectively.

Table 17. Logit estimation results with socioeconomic variables for the censored sample

Variable	Voluntary	Mandatory	Pooled
VOLUNT	-	-	-0.95(0.42)**
CONSTANT	-1.34(1.96)	1.90(1.42)	-0.13(0.99)
BID	-0.29(0.06)***	-0.07(0.02)***	-0.13(0.02)***
PVSUIT	1.95(0.83)**	2.08(0.64)***	1.55(0.42)***

PROTSPO	0.29(0.52)	-0.32(0.39)	-0.55(0.29)*
AGE	0.03(0.03)*	-0.01(0.02)	0.002(0.01)
PEOPLE	-0.51(0.29)*	0.27(0.20)	0.01(0.14)
INCOME	0.37(0.09)***	0.20(0.05)***	0.20(0.03)***
PET	2.45(1.17)**	1.98(0.84)**	2.07(0.62)***
MENVTO	5.82(1.83)***	-	2.90(1.34)**
LL_U	-29	-46	-88
LL_R	-92	-86	-179
Pseudo R^2	0.68	0.47	0.51
% Correct predictions	91%	87%	84%
Observations	135	134	269

[a] Numbers in parentheses are standard error. *** Significant at $p<0.01$, **Significant at $p<0.05$, *Significant at $p<0.1$.

3.2.3 Mean WTP from two payment vehicles

Using both non-parametric and parametric (univariate and multivariate) analysis, a statistically significant difference in WTP responses in two payment vehicle comparisons is found. The elicited WTP is higher under a mandatory payment method than a voluntary one, which is consistent with the theory of Carson et al. (2000) and some recent observations (Timothy, 2001; Fehr and Schmidt, 2001; Ryan, 2007). It is observed that Macao residents moderately preferred the mandatory payment to the voluntary payment. Respondents thought that other households should pay also the same specified amount for providing a public good as what they are paying.

One explanation for this observation is the traditional economic concept of "free riding" and "truth telling". If survey respondents are assumed to answer CV questions "truthfully" (i.e., as if they are faced with a true economic choice to voluntarily contribute), free riding might be used to predict that the stated WTP under voluntary payment would be lower than the elicited WTP under the mandatory scheme (Champ et al., 2002; Ryan, 2007). Another explanation is that under a voluntary payment, the Nash equilibrium exists, in which the level of public good provided is strictly below the level provided under a mandatory provision rule (Timothy, 2001). Fewer individuals will be willing to pay to help provide public goods in a voluntary situation than in a mandatory one.

3.2.4 Extrapolation of WTP benefits

The total benefits of black-faced Spoonbill conservation in Macao can be estimated by aggregating the mean WTP values to get the total WTP amount.

This study used the simple transferring point estimate (STPE) approach to extrapolate the total benefits of the black-faced Spoonbill conservation in Macao. Feather and Hellerstein (1997) found that the accuracy of the results obtained from STPE is better compared with the results from the benefits function transfer approach (BFTA), which tends to create large biases when a major difference exists in the value of the non-market commodity to the different social segments in the same society. Hadker et al. (1997); Loomis and Ekstrand (1998); Loomis et al. (2000); Chambers and Whitehead (2003); and Bandara and Clem (2004) used the STPE method to aggregate the mean WTP values.

This study found significant effects of payment vehicle. To reduce these effects, the mean WTP derived from logit estimation of the pooled data set was used to extrapolate the total WTP. Comparing Table 13 with Table 15 and Table 16 with Table 17, the models with covariates are found to be superior to the model without covariates in terms of the goodness of fit (Pseudo R^2 or percentage correction predictions). Hence, the mean WTP values from the models with covariates were used for aggregation.

According to the logit estimation results with socioeconomic variables included for the entire sample (i.e., including all the zero responses), the mean WTP is MOP9.51 (US$1.19) per household per month in 5 years. If all Macao households (about 149 thousand in 2005) are considered, the WTP is MOP1.39 (US$0.17) million per month. This amounts to an annual value of MOP16.68 (US$2.1) million. As the payment will be made over a period of 5 years, the total net present discounted value of these annual amounts, at 5% real rate of discount, equals MOP75.83 (US$9.48) million. Based on the scenario that the fund could then request international organizations to provide the same amount of money, or more, according to the money raised locally, the total benefits would double to MOP151.66 (US$18.96) million.

Using the censored sample only, the mean WTP from the logit estimation results with socioeconomic variables included in the pooled data is MOP25.13 (US$3.14) per household per month in 5 years. For the household size, 32% was deducted from the whole population to allow for protest and uncertain responses, which means that the WTP of those with protest bids and uncertain answers was treated as zero. The resulting number of households was 101,320. Finally, a WTP of MOP2.55 (US$0.32) million per month for the conservation of black-faced Spoonbills in Macao was obtained. This amounts to an annual value of MOP30.55 (US$3.82) million. The total present discounted value of these annual amounts, at a 5% real rate of discount, equals MOP136 (US$17) million for a period of 5 years. Also based on the scenario of having counterpart funds from international organizations, the total benefits would double to MOP272 (US$34) million.

3.3 Cost estimation and benefit-cost comparison

The black-faced Spoonbill conservation would involve opportunity costs and management costs. Officials of the Environmental Council of Macao SAR government estimate the management costs to be about MOP1.5 (US$0.2) million every year. The question that needs to be considered is what would be the opportunity cost of protecting the black-faced Spoonbill in the ecological zone.

The opportunity costs of a protected area are the future economic benefits from the land being lost by the landholder. In a perfect market situation, the market value of a property, if freehold, should represent its economic value (Tisdell et al., 2005). Because the land under consideration is government owned and is not readily marketable, the study obtained a comparable land quite close to the ecological zone. The latter was sold by the Lands, Public Works and Transport Bureau of Macao SAR government to Great China Limited Company. The file says "36640 m^2…reclaimed land…[priced at] MOP16,300,000" (Imprensa Official of Macao SAR government, 2006). Since the 15-ha ecological zone is quite similar to the sold land, the former was valued at MOP66.73 million. However, another 40-ha ecological zone is mainly wetland or river bank. Based

on consultations from researchers in Macao and Hong Kong, the value of this zone is priced at 10% of the sold land, which is about MOP17.80 (US$ 2.23) million. Thus, the total opportunity cost of the ecological zone is about MOP84.53 (US$10.57) million. The total cost of the conservation program in 5 years is about MOP90.03 (US$11.50) million.

With regard to the social cost-benefit analysis (CBA), even when the conservative aggregation results used were based on the entire sample, the total benefits of black-faced Spoonbill conservation in Macao (MOP 151.66) are greater than the total costs (MOP90.03). Thus, it can be concluded that setting aside the critical habitat for black-faced Spoonbill conservation would result in net benefits, which could increase the social welfare.

Moreover, it is possible that the benefits of preserving the habitat of the black-faced Spoonbill may be significantly greater than indicated by just the willingness to pay to conserve this single species (Tisdell et al., 2005). This is because this habitat is also home to other valued wildlife species. Given that some of these other species and the ecosystem where they reside have economic value, the economic benefit from conserving the habitat of the black-faced Spoonbill could exceed that attributed to the black-faced Spoonbill alone.Based on the experiences of the Maipo natural area in Hong Kong, in addition to providing benefits for the local residents, the conservation of the black-faced Spoonbill and its habitat is expected to attract tourists from neighboring regions to Macao, such as from Hong Kong and the mainland of China, which can generate other benefits.

4.0 EXPERIMENT ON HYPOTHETICAL AND REAL WTP

4.1 Introduction

The CVM is the most frequently used method to elicit respondents' WTP for environmental public goods (Mitchell and Carson, 1989; Bishop and Romano, 1998; Carson et al., 2001). However, there are some debates about whether or not CVM can measure accurately the respondents' maximum WTP (Diamond and Hausman, 1994; Portney, 1994). The nucleus of the controversy is the extent to which hypothetical choices in CVM correspond to real economic choices (Carlsson and Martinsson, 2001). The actual WTP can be compared with the hypothetical WTP to assess the validity of a CVM study (Freeman, 2003). This kind of comparison is often called tests of criterion validity.

This study conducted a validated experiment on Macao respondents to test whether or not the mean WTP in a hypothetical market differs from that in a real market, which could be used to infer the hypothetical bias in the large scale CVM study about black-faced Spoonbill conservation in Macao.

4.2 Research Design

The experiment involved two independent treatments:

Treatment 1: WTP in a hypothetical (hpy) market

Treatment 2: WTP in a real cash market.

The hypothesis to be tested is:

$$H_0: \text{WTP (hyp)} = \text{WTP (real)}$$

4.3 Experimental Design

4.3.1 Good selection

The ultimate goal of CVM is to value public goods. However, the difficulty of bringing non-deliverable public goods to the laboratory led to the use of private goods in the experimental setting. Murphy and Stevens (2004) believe that the familiarity and convenience of using private goods are likely to elicit accurate willingness to pay estimates. However, the goods selection must be able to share the characteristics of the target good used in the large scale CVM surveys.

For the good selection, following Loomis et al. (1997), first, the good needs to be one that is infrequently purchased and for which there is a fair amount of price dispersion in the market, so that most people would not be familiar with the market price. The objective is to minimize the likelihood that the respondent would simply try to use the market price in responding to the WTP question. Second, a good with readily observable characteristics is desirable, so there would be minimal ambiguity about the product. Third, to distinguish this experiment from others, the good needs to be relevant to the black-faced Spoonbill conservation study in order to validate the WTP estimation in the CVM study.

Given these characteristics, the experiment used a t-shirt with a picture of a black-faced Spoonbill printed on it.

4.3.2 Subject recruitment

The subjects involved in this experiment were recruited from the respondents for the final questionnaire survey on the black-faced Spoonbill conservation in Macao. An invitation letter was included in the last part of the questionnaire (see Appendix A). After finishing the survey questionnaire, the respondents were asked if they would be interested in participating in a scientific study that involved interview experiments. They were offered MOP100 (~ US$12) in cash to participate in the experiment. Individuals who agreed to participate in the study were asked to choose a mutually convenient date and time for the interview.They were phoned two days before the experiment began to make sure that they would really be able to participate in the experiment.

4.3.3 Experiment questionnaires

The experiment involved two different experimental groups referred to as the “hypothetical group” and the “real group”. A short written description of the t-shirt was given to all the subjects. The interviewer read aloud the description and responded to any questions that the respondents had regarding the good. Then the interviewer gave the subjects a written copy of the survey and asked them about their preferences regarding the t-shirt. The study used the payment card elicitation method. Each subject was presented with a series of amounts of money ranging from $1.00 to $2.25 in 25-cent

increments, and asked to put a "√" on "I would buy" or "I would not buy" for each price given (Table 18). The full script is provided in Appendix B.

Table 18. Price of the t-shirt that the experiment respondents were willing to pay

No	Price (US$)	Would buy	Would not buy
1	1.00	_____	_____
2	1.25	_____	_____
3	1.50	_____	_____
4	1.75	_____	_____
5	2.00	_____	_____
6	2.25	_____	_____

The hypothetical group's subjects were asked their hypothetical WTP for the t-shirt. As in a large scale CV study, one cheap talk description was included before the WTP question to reduce the hypothetical bias. After the WTP question, the subjects were asked about their maximum WTP for the t-shirt using an open-ended question. If they indicated unwillingness to buy the t-shirt at any price, they were asked to give their reasons.

On the other hand, the real WTP group's subjects were given a real opportunity to participate in the t-shirt auction. The auction mechanism used was the Becker-Degoot-Marschak (BDM) (Lusk et al., 2004). Aside from its simplicity, the BDM is an incentive compatible auction mechanism where bidders truthfully reveal the amount they would be willing to pay. It is considered to elicit the best response irrespective of the strategies adopted by the players.

The rules of the BDM mechanism are straightforward. Each player or subject was given a sheet of paper indicating the six price offers shown in Table 18 and asked to check either the "would buy" or "would not buy" column for each stated price. After the subjects finished answering, the interviewer collected the answer sheets and randomly drew a sale price from a jar containing all the prices listed in Table 18. Any subject, who submitted a bid greater than or equal to the drawn price, received the good and paid an amount equal to the sale price. The others who bid lower than the sale price did not pay and went home without the good.

In the real group experiment, the subjects were asked to think over the amount they were willing to pay and to give their true preferences. They were told that overbidding increases the likelihood that they will have to pay more for the good than desired, while underbidding increases the likelihood that they will not get the chance to buy the good. Finally, the subjects were also debriefed.

4.4 Experimental Results and Discussion

4.4.1 Background characteristics

A total of 77 respondents showed up for the experiment. Of these respondents, 40 were randomly included in the real group, and the remaining 37 became the hypothetical group. Table 19 shows the socioeconomic information of the subjects in the experiment and in each group.

Table 19. Respondents'main socioeconomic information

Variable	All participants		Hypothetical group		Real group		t-statistics
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	
AGE	32.26	13.54	32.89	13.60	31.68	13.63	0.39
GENDER	0.39	0.49	0.35	0.48	0.43	0.50	-0.66
CIVSTAT	0.44	0.50	0.46	0.51	0.43	0.50	0.30
EDUC	3.40	0.71	3.35	0.68	3.45	0.75	-0.61
PEOPLE	3.88	0.90	3.92	0.80	3.85	1.00	0.33
NP15	0.61	0.75	0.65	0.82	0.58	0.68	0.43
NEM	1.83	0.71	1.86	0.71	1.80	0.72	0.40
DONACH	0.75	0.59	0.76	0.72	0.75	0.44	0.05
DONAENVI	0.14	0.35	0.14	0.35	0.15	0.36	-0.18
MENVTO	0.05	0.22	0.03	0.16	0.08	0.27	-0.94
PET	0.30	0.46	0.22	0.42	0.38	0.49	-1.52
INCOME	12506.49	8058.38	12337.84	8081.23	12662.50	8136.96	-0.18

The average age of the subjects was 32.26 years old, which is a few years lower than the average age of the whole sample for the questionnaire survey (35.33 years old). Male accounted for only 39% of the subjects. This is understandable because in Macao, men usually do not like to participate in any public experimental activities. The subjects' average educational level was between senior high school and college in all three cases (3.40), which was a bit higher than the average educational level of the respondents in the final questionnaire survey (3.27). The reason for this is that perhaps a person who has a higher educational level would more likely to participate in a research or experiment.

The average number of household members was 3-4 with a mean less than one person below 15 years old. On the average, about two household members earned income. Of the all respondents, 75% had donated to a charitable cause in the past year; this is higher than the average of the survey sample (57%). Thirty percent of the respondents indicated having pets in their households, which is also higher than the average of the survey sample (24%). The mean household monthly income was about MOP12506 (US$1563), a little lower than the average of the whole sample (MOP15897). This could be because rich people care more about their time and leisure.

A two-sample mean comparison test shows that none of the socioeconomic characterisitics of the hypothetical group is different from that of the real group.

4.4.2 Mean WTP comparison

No zero WTP was found in the hypothetical group. However, in the real group, 5 subjects indicated zero WTP. Four of them did so because they said they didn't like the t-shirt at all. One said he did not like to attend any auction activities.

The WTP elicitation method used in both groups was the payment card (PC). However, when the PC WTP data was being analyzed, it was not clear what assumptions should be made about the respondent's true WTP. The standard procedure is to assume that the true WTP is the mid-point between the amount at which the respondent said "yes" and the amount at which he/she said "no" (Cameron and James, 1987, Ryan, 2007). Such an approach allows the WTP to be estimated indirectly without regression

techniques and therefore no assumptions have to be made about either the functional form of the utility function or the appropriate method of analysis (Ryan, 2007). Thus, this study adopted the mid-point approach to estimate the mean WTP (Table 20)

Table 20. Mean WTP results of the experimental groups (US$)

	Mean WTP	Std. Dev.	95% CIs
Hypothetical	1.78	0.35	1.08-2.47
Real	1.45	0.72	0.05-2.86

As Table 20 shows, the 95% confidence intervals (CI) of the derived hypothetical WTP are completely contained within the 95% CI of the real WTP, suggesting that the hypothetical WTP is not significantly different from the real WTP (Loomis et al., 1997). The ratio of the hypothetical mean WTP to the real mean WTP is about 1.22.

Next, to identify the characteristics of those who are more (less) willing to pay for the T-shirt, the data were subjected to ordinary least squares (OLS) regression to estimate the attitudes toward payment as a function of a set of behavioral and demographic variables. These variables include age, household monthly income, WTP for the conservation program in the questionnaire survey, etc. Tables 21 and 22 present the regression results for both hypothetical and real groups, respectively, when the WTP obtained from the mid-point approach was used as the dependent variable.

Table 21. OLS regression results for the hypothetical group

Variable	Coefficient	Std Error	*t*-value	*p*-value
Constant***	12.51	2.74	4.57	0.00
AGE	0.03	0.03	1.02	0.32
EDUC	-0.40	0.68	-0.59	0.56
QWTP	0.04	0.03	1.58	0.12
INCOME**	0.00	0.00	2.23	0.03

Note: *** Significant at $p<0.01$. ** Significant at $p<0.05$.

The regression results show that, for the hypothetical group, the coefficient of INCOME is positive and significant at 5% level, as expected. This finding suggests that for the subjects in the hypothetical group, income is one determinant for their WTP. The subject who has more household income would be willing to pay more for the valued good.

Table 22. OLS regression results for the real group

Variable	Coefficient	Std Error	*t*-value	*p*-value
Constant	0.07	4.28	0.02	0.99
AGE*	0.16	0.09	1.86	0.07
EDUC*	4.93	2.61	1.88	0.07
QWTP**	0.09	0.04	2.27	0.03
INCOME	0.00	0.00	1.17	0.25

Note: ** Significant at $p<0.05$. * Significant at $p<0.1$.

For the real group, the estimated results show that the coefficient of the age variable is statistically significant at 10% level with a positive sign. This indicates that the older subjects would be willing to pay more for the t-shirt than the younger subjects. The reason for this could be that the t-shirt is not fashionably designed. Similarly, the coefficient of education variable appears to be significant at 10% level with the expected positive sign. This sign indicates that the higher the education level, the higher the willingness to pay for the t-shirt. The variable QWTP is the WTP amount for the black-faced Spoonbill conservation program in the final questionnaire survey. The coefficient for QWTP is positive and significant at 5% level, as expected. This indicates that the person who has a higher WTP for the conservation program would pay more for the t-shirt.

4.4.3 Discussion

The experiment results show that no significant differences were found between the derived hypothetical mean WTP and the real mean WTP. The ratio of the hypothetical mean WTP to the real mean WTP is about 1.22. The findings of this study can be compared with those of Bishop et al. (1992), where the mean hypothetical WTP exceeded actual WTP by a factor of 1.23 and the two estimates were not found to be significantly different. This is a welcome result.

Several possible reasons can explain this finding. Firstly, a cheap talk scipt was used in the hypothetical group. The respondents were reminded of their budget constraints and asked to consider seriously their WTP. This may have reduced the hypothetical bias of the hypothetical group. On the other hand, the subjects in the real group were asked to give their true willingness to pay. They were told that overbidding will cause them to pay more and underbidding will cause them to lose the chance to get the valued good. These two scripts can result in the respondents in both the hypothetical group and the real group telling their true WTP. Secondly, the subjects in this experiment were recruited from the large scale questionnaire survey for the black-faced Spoonbill conservation in Macao. It is possible that the respondents who were interested in the conservation program may also be the ones who participated in the experiment. They had a better knowledge about black-faced Spoonbill. Hence, the respondents would have a greater probability to give a true WTP for the t-shirt, a useful proxy for the valued good in the large scale CVM survey study. The last possible reason could be that the sample size for the experiment is small.

This experiment indicates that the respondents in Macao behaved rationally in that the hypothical mean WTP in the experiment is not significantly different from the real mean WTP. However, since the good used in this experiment is a private good (i.e., it has different characteristics from the public good), it may not be appropriate therefore to use the experiment results to calibrate the mean WTP of the large scale questionnaire survey.

5.0 CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Conclusions

Determining the values of an endangered species conservation that has little or no market place context has proved to be a daunting task. Conducting a valid and reliable valuation study would be very useful in generating a better and more comprehensive information base for policy formulation and decision making (Turner et al., 2003). This study employed the dichotomous choice contingent valuation method to value the economic benefits of black-faced Spoonbill conservation in Macao based on public's preferences.

The survey results show that the public did not consider environmental issues as the biggest problem facing the government, although the majority of the respondents thought the environment and natural resources in Macao are not properly taken care of. Much emphasis was put on social and economic problems. With regard to the most important environmental problem in Macao, endangered species conservation was similarly not given priority compared with air and water pollution. The results also reveal that the majority have existence values and altruism values for endangered species conservation. However, the public's knowledge of the black-faced Spoonbill, the good to be valued in this study, was relatively poor.

A split sample design was used to investigate the effect of two different payment vehicles. One was a mandatory surcharge on household water bill every month in 5 years and the other was a voluntary surcharge on household water bill every month in 5 years. Data showed that the mean WTP is significantly higher under the mandatory payment method than the voluntary one. These results are consistent with the theory of Carson et al. (2000) and observations of Timothy (2001) and Ryan (2007).

The logit regression analysis reveals that the probability of a "yes" response to the valuation question varies with a number of explanatory variables in a reasonable and expected fashion, thereby offering some support for the construct validity of this CV application. Household income, age, bid level, pet and perceptions of the valued good were significant determinants of the respondents' responses to the WTP question. The high predictive power and statistical reliability of the models obtained in this study suggest that a carefully designed CV study can be successfully conducted in developing countries to measure the non-market benefits for rare and endangered species conservation.

To obtain the total benefits of the black-faced Spoonbill conservation in Macao, the study used the estimation results of the pooled model in order to remove the payment vehicle effect. If the entire sample (including all zero answers) was considered, the conservative total benefit estimate is MOP75.83 (US$9.48) million. But if the protest responses are removed and uncertain answers to the WTP question are adjusted, the total benefits would reach up to MOP136 (US$17) million. Considering the scenario that the fund could be matched by some international organizations, the total benefits would be doubled for each case. The total costs of the conservation program was estimated at about MOP90.03 (US$11.25) million.

With regard to the social cost-benefit analysis, the study found that even the conservative aggregation results based on the entire sample was used, the total benefits of black-faced Spoonbill conservation in Macao (MOP151.66) are still greater than its total costs (MOP90.03).

The good being valued in this study is an endangered species and the public is not very familiar with it. In the context of a CV survey, the in-person interview would appear to face some potentially serious limitations. A relatively new survey mode called drop-off was used to give the respondents more time to obtain information on the good to be valued and to think seriously about their valuations; this method was expected to increase the reliability of the estimation results. The study results show that this survey method can be potentially employed in the context of a developing country.

The results of the hypothetical and real WTP experiment show that the mean hypothetical WTP is not significantly different from the real WTP. The ratio of hypothetical WTP to real WTP is about 1.22. This is a starting point for conducting experiments to test the reliability of the stated preference methods in Macao.

5.2 Policy Implications

The findings of the study provide some implications that can be useful to inform decisions and policies about black-faced Spoonbill conservation in Macao.

The survey results reveal that the public's knowledge of the black-faced Spoonbill is relatively poor. The extent of respondents' knowledge of environmental goods significantly influences their stated demand for these and by implication, actual demand (Tisdell and Wilson, 2006). Increased investments in public education and communication programs can enhance the knowledge, attitudes and perceptions of people about black-faced Spoonbill conservation and environmental conservation. This will contribute to the reduction of the damage to the natural habitat of black-faced Spoonbills and will encourage the public to be willing to pay more for a better management and conservation of the ecological zone.

Further, the payment vehicle would have a significant impact on people's stated willingness to pay for the black-faced Spoonbill conservation in Macao. The study found that the mandatory payment is moderately preferred to the voluntary payment by Macao residents. People behave as if they care about fairness in terms of providing a public good. Respondents thought that other households should also pay the same specified amount as they would. Thus, based on the results of this study, policymakers should be careful about the impacts of the payment context on the public's stated willingness to pay to encourage fund contribution to environmental programs.

The empirical results show that the Macao public does have a positive WTP for the conservation of black-faced Spoonbill in Macao. This implies that a significant economic value will be lost from any large-scale development that would destroy the species' habitat. Moreover, the proposed conservation program passed the social cost-benefit analysis. To protect the benefits of the public and increase the social welfare, policymakers would be wise to place more weight on the conservation of black-faced Spoonbills by banning activities that degrade their natural habitat and to requiring all

economic activities close to the habitat to be subjected to the environmental impact assessment (EIA).

Because the black-faced Spoonbill is a beautiful and rare bird, according to the experiences of the Maipo natural area in Hong Kong, it may have a high use value to sightseers. Thus, if the ecological zone can be managed as an ecotourism park, it will attract more visitors to Macao. This would contribute to the development of the area's tourism industry and the improvement of environmental awareness of the public in Macao.

The total benefits of preserving the habitat for black-faced Spoonbill may be significantly higher than indicated by just the willingness to pay to conserve this single species (Tisdell et al., 2005). Possibly an appropriate and more defensible goal would not only be to conserve the black-faced Spoonbill but to maximize conservation efficiency by aiming to sustain the whole ecosystem in which the black-faced Spoonbill exists.

REFERENCES

Amirnejad Hamid, Khalilian Sadegh, Mohammad H. Assareh and Majid Ahmadian, 2005. Estimating the existence value of north forests of Iran by using a contingent valuation method, Ecological Economics, In Press, Corrected Proof, Available online 5 October 2005.

Bandara Ranjith and Clem Tisdell, 2004. The net benefit of saving the Asian elephant: a policy and contingent valuation study. Ecological Economics, 48, 93-107.

Bateman Ian J., Richard T. Carson, Brett Day, Michael Hanemann, Nick Hanley, Tannis Hett, Michael Jones-Lee, Graham Loomes, Susana Mourato, Ece Özdemiroglu, David W. Pearce OBE, Robert Sugden, John Swanson, 2002. Economic Valuation with Stated Preference Techniques: A Manual. Cheltenham, Edward Elgar.

Berrens, R. P., H.J. Smith, A.K. Bohara, C.L. Silva, 2002. Further investigation of voluntary contribution contingent valuation: fair share, time of contribution, and respondent uncertainty. Journal of Environmental Economics and Management 44, 144-168.

Bird Life International. 2000. Threatened Birds of the World. Lynx Edicions and Bird Life International, Barcelona and Cambridge, UK.

Bishop, R. M., M. Welsh, and T. Heberlein, 1992. Some experimental evidence on the validity of contingent valuation. Department of Agricultural Economics, University of Wisconsin.

Bishop, R.C. and D. Romano, 1998. Environmental Resource Valuation: Application of the Contingent Valuation Method in Italy. Kluwer Academic Publisher, The Netherlands.

Blaine T. W., F.R. Lichtkoppler, K.R. Jones, and R.H. Zondag, 2005. An assessment of household willingness to pay for curbside recycling: a comparison of payment card and referendum approaches. Journal of Environmental Management 76, 15-22.

Blumenschein Karen, Magnus Johannesson, Krista K. Yokoyama and Patricia R. Freeman, 2001. Hypothetical versus real willingness to pay in the health care sector: results from a field experiment. Journal of Health Economics, 20, 441-457.

Bulte, E.H. and R.D. Horan, 2003. Habitat Conservation, Wildlife Extraction, and Agricultural Expansion. Journal of Environmental Economics and Management, 45, 109-127.

Braden, J. B., C.D. Kolstad, and D. Miltz (eds), 1991. Measuring the Demand for Environment Quality. Elsevier Science Publishers, North-Holland.

Brouwer, R. and F.A. Spaninks, 1999. The validity of environmental benefits transfer: further empirical testing. Environ. Econ. Manage. 14, 95– 117.

Cameron, T. A. and James, M. D., 1987. Efficient estimation methods for "closed-ended" contingent valuation surveys. Review of Economics and Statistics, 69(2), 269-272.

Carson R. T., T. D. Groves and M.J. Machina, 2000. Incentive and Informational Properties of Preference Questions. http://eco.ucsd.edu/rcarson.

Carson Richard T., Nicholas E. Flores, and Norman F. Meade, 2001. Contingent Valuation: Controversies and Evidence, Environmental and Resource Economics, 19: 173-210.

Carlsson F. and P. Martinsson, 2001. Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments? Application to the Valuation of the Environment, Journal of Environmental Economics and Management, 41(2), 179-192.

Chambers, Catherine and John C. Whitehead, 2003. A Contingent Valuation Estimation of the Benefits of Wolves in Minnesota. Environmental and Resource Economics 26, 249-267, 2003.

Champ, R., R. Bishop, T. Brown, and D. McCollum, 1997. Using donation mechanism to value non-use benefits from public goods. Journal of Environmental Economics and Management 33, 151-163.

Champ, P., N. Flores, T. Brown, J. Chivers, J., 2002. Contingent valuation and incentives. Land Economics, 78(4), 591-604.

Chilton, S. and W. Hutchinson, 1999. Some further implications of incorporating warm glow of giving into welfare measures: a comment on the use of donation mechanisms by Champ et al. Journal of Environmental Economics and Management 37, 202-209.

Cooper, J., 1994. A comparison of approaches to calculating confidence intervals for benefit measures from dichotomous choice contingent valuation survey. Land Econ. 70, 111 –122.

Davis, R.K., 1963. The Value of Outdoor Recreation: An Economic study of the Maine Woods. PhD dissertation, Harvard University.

Diamond Peter A. and Jerry A. Hausman, 1994. Contingent valuation debate: is some number better than no number? Journal of Economic Perspectives, 8(4), 45-64

Duffield, J. and D. Patterson, 1991. Inference and Optimal Design for a Welfare Measure in Dichotomous Choice Contingent Valuation. Land Economics 67(2), 225–239.

Environment Council of Macao SAR government, 2002. Report on the state of the Environment of Macao. Environment Council of Macao SAR Government, Macao.

FAO, 2000. Application of the Contingent Valuation Method in Developing Countries: A Survey Information Division, Food and Agricultural Organization of the United Nation, Viale delle Terme di Caracalla, Rome, Italy.

Feather, P.and D. Hellerstein, 1997. Calibrating benefit function transfer to assess the conservation reserve program. Am. J. Agric. Econ. 79, 151–162.

Fehr, Ernst and Klaus Schmidt, 2001. Theories of Fairness and Reciprocity – Evidence and Economic Applications. Working Paper No. 75, Institute for Empirical Research in Economics, University Zurich.

Freeman, A.M., III, 2003. The measurement of environmental and resource values: theory and methods. Resources for the Future, Washington DC.

Giraud, K., B. Turcin, J. Loomis, and J. Cooper, 2002. Economic benefit of the protection program for the Steller sea lion. Marine Policy, 26, 451-458.

Greene, W. H., 2000. Econometric Analysis. London: Prentice Hall International, cop.

Greene, W. H., 2002. LIMDEP Version 8.0, Econometric Modelling Guide. NY: Econometric Software Inc.

Hadker, N., S. Sharma, A. David, T.R. Muraleedharan, 1997. Willingness to pay for Borivli National Park: evidence from a contingent valuation. Ecol. Econ. 21, 105–122.

Hanemann, M, 1984. Welfare evaluations in contingent valuation experiments with discrete responses, American Journal of Agricultural Economics, 66(3), 332-341.

Hanemann, W. M., 1989. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics 71(4), 1057-1061.

Hanemann, W. M., J. Loomis, and B. Kanninen, 1991. Statistical efficiency of double bounded dichotomous choice contingent valuation. Amer. J. Agr. Econ. 73, 1255-1263.

IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Accessed 04 June 2006.

Imprensa Official of Macao SAR Government, 2006. http://www.imprensa.macau.gov.mo/cn/. Accessed on 6 June 2006.

Lee Choong-Ki, 1997. Valuation of nature-based tourism resources using dichotomous choice contingent valuation method. Tourism Management, Vol. 18, No. 8, 587-591.

Leung Chee-Va, 2003. The black-faced Spoonbill – Precious Bird of Macao. Macao: The Association of Promotion of Science and Technology of Macao.

Loomis, John B., 1988. Contingent valuation using dichotomous choice models. Journal of Leisure Research, 20(1), 46-56.

Loomis, J., A. Gonzalez-Caban, and R. Gregory, 1995. Do reminders of substitutes and budget constraints influence contingent valuation estimates. Land Economics, 70(4), 499-506.

Loomis, J. and D. White, 1996. Economic benefits of rare and endangered species: summary and meta-analysis. Ecological Economics, 18, 197-206.

Loomis J., T. Brown, B. Lucero and G. Peterson, 1997. Evaluating the validity of the dichotomous choice question format in contingent valuation. Environmental and Resource Economics, 10, 109-123.

Loomis, J.B. and E. Ekstrand, 1998. Alternative approaches for incorporating respondent uncertainty when estimating willingness to pay: the case of Mexican spotted owl. Ecol. Econ. 27, 29– 41.

Loomis, J.B., P. Kent, L. Strange, K. Fausch, A. Covich, 2000. Measuring the total economic value of restoring ecosystem service in an impaired river basin: result from a contingent valuation survey. Ecol. Econ., 33, 103– 117.

Lusk J. L., T. Feldkamp and T.C. Schroeder, 2004. Experimental auction procedure: impact on valuation of quality differentiated goods. American Journal of Agricultural Economics, 86(2), 389-405.

Macmillan D. C., Lorna Philip, Nick Hanley, Begona Alvarez-Farizo, 2002. Valuing the non-market benefits of wild goose conservation: a comparison of interview and group-based approaches. Ecological Economics, 43, 49-59.

McNeely, J. A. and J.J. Scherr, 2003. Ecoagriculture: Strategies to feed the world and save wild biodiversity. Washington, DC: Island Press.

Mitchell, R. C. and R. T. Carson. 1989. Using surveys to value public goods. The contingent valuation method. Resources for the Future. Washington DC.

Moran, Dominic, 1994. Contingent valuation and biodiversity: measuring the user surplus of Kenyan protected areas. Biodiversity and Conservation 3, 663-684.

Murphy, J. and T. Stevens, 2004. Contingent Valuation, Hypothetical Bias and Experimental Economics. Agricultural and Resource Economics Review. 33(2), 271-281.

Ninan K. N. and J. Sathyapalan, 2005. The economics of biodiversity conservation: a study of a coffee growing region in the Western Ghats of India. Ecological Economics 55, 61-72.

NOAA, 1993. Natural Resource Damage Assessments: Proposed Rules. Federal Register 59 (5), 1062_/1191.

OECD, 2002. Handbook of Biodiversity Valuation: A Guide for Policy Makers OECD, Paris.

Portney, Paul R., 1994, The Contingent Valuation Debate: Why Economists Should Care. Journal of Economic Perspectives, Vol. 8, No. 4, 3-17.

Randall, A. and J. Stoll, 1983. Existence value in a total valuation framework. In: R. Rowe and L.Chestnut (Editors), Managing air quality and scenic resources at national parks and wilderness areas. Westview Press, Boulder, CO.

Ryan, Wiser, 2007. Using contingent valuation to explore willingness to pay for renewable energy: a comparison of collective and voluntary payment vehicles. Ecological Economics, 62, 419-432.

Salazar, S. D. and J.M. Marques, 2005. Valuing cultural heritage: the social benefits of restoring and old Arab tower. Journal of Cultural Heritage, 6, 69-77.

Statistics and Census Department, 2003. Yearbook of Statistics. Statistics and Census Department, Macao.

Stevens T. H., R. Belkner, D. Dennis, D. Kittredge and C. Willis, 2000. Comparison of contingent valuation and conjoint analysis in ecosystem management. Ecological Economics, 32 (1), 63-74.

Tapvong Churai and Kruavan Jittapatr, 1999. Water Quality Improvements: A Contingent Valuation Study of The Chao Phraya River. EEPSEA Research Report. Available online http://203.116.43.77/publications/research1/ACF23D.html

Timothy K. M. B., 2001. Three essays on contingent valuation. PhD Dissertation, University of California, Berkeley.

Tisdell Clem, Clevo Wilson and Hemanath Swarna Nantha, 2005. Policies for saving a rare Australian glider: economics and ecology. Biological Conservation, 123(2), 237-248.

Tisdell C. and Wilson C, 2006. Information, wildlife valuation, conservation: experiments and policy. Contemporary Economic Policy, 24(1), 144-159.

Turner R. Kerry, Jouni Paavola, Philip Cooper, Stephen Farber, et al., (?pls list all authors) 2003. Valuing nature: lessons learned and future research directions. Ecological Economics, 46, 493-510

White, P.C.L., A.C. Bennett, E.J.V. Hayes, 2001. The use of willingness to pay approaches in Mammal conservation. Mammal Rev. 31, 151-167.

Yu, Y.T. 2004. International black-faced Spoonbill Census: 16-18 January 2004. The Hong Kong Bird Watching Society. Hong Kong.

Appendix A. Questionnaire for the Black-faced Spoonbill Conservation Survey

Hello! We are currently conducting a survey on understanding public opinions for some public programs in Macao, one of which might be wildlife endangered species conservation. This survey is sponsored by the Economy and Environment Program for Southeast Asia (EEPSEA). You have been randomly chosen to participate in this survey.

You will be asked some questions. There is no right or wrong answer. We promise that all information provided in this survey will be kept strictly confidential and will be used for research only. We are after your honest responses. It will take you about 30-40 minutes to finish this questionnaire.

If this questionnaire is fully accomplished, you will be qualified for a raffle, which will give you a chance to win the following: FIRST PRIZE (1 person, $100), SECOND PRIZE (2 persons, $50 each) and THIRD PRIZE (4 persons, $10 each), during a draw to be held on <date time>. If you win, we will contact you directly.

Would you like to participate in this survey? Yes:_____ No:_____

(If the respondent agrees to participate in this survey, the enumerator will leave the questionnaire and explain to the respondent how the skip patterns work. The enumerator and the respondent will discuss the time and date when the enumerator will come back to collect the questionnaire.)

Note: We would like to request that only the household head (husband/wife/employed sons or daughters who is in charge of the daily expenditures and other younger family members) answer the questionnaire. But you may consult with other members of your household when answering the questionnaire if you wish. We also request that you NOT discuss the questions with your neighbors or other people outside your immediate household before you provide your answers.

If you have any question, please make notes of any questions you might have. We will try to answer your questions when we come back to pick up the questionnaire. Or you can contact Ms. Jin at 3978526.

Thank you for your help with this survey!

Basic Information:

Reference No. of Respondent: _____

Home Address: _____

Name of Respondent (Optional): _____

Name of Interviewer: _____

Questionnaire No.: _____

Date of Questionnaire Left: _____

Date of Questionnaire Picked Up: _____

SECTION 1: PROBLEMS FACED BY OUR GOVERNMENT

1. In your opinion what are the **BIGGEST PROBLEMS** facing our government today?

Problem	Your choice
1. Economic Problems	
2. Social Problems:	
a. Poverty	
b. Education	
c. Health	
d. Others: crime, violence, inequality	
3. Infrastructure (e.g. roads, water)	
4. Environment	
5. Terrorism	
6. Others 1: _____	
Others 2: _____	

2. Do you think the environment and natural resources in Macao are properly taken care of?

Yes	_____	Envtcare	
No	_____		

3. What do you think are the **THREE MOST** serious issues related to nature and human impact on the natural environment (1 as most serious) in Macao?

Natural Resource & Environmental Problems	Rank (Choose which is 1, 2 & 3)
1. Air pollution	
2. Water pollution	
3. Solid waste management	
4. Endangered species conservation	
5. Deforestation	
6. Traffic noise/problems	
7. Enhanced greenhouse effect	
8. Others, please specify_____	

Note: Endangered species are plants and animals considered to be facing a high risk of extinction.

SECTION 2: ATTITUDINAL & KNOWLEDGE QUESTIONS

4. In terms of endangered species conservation in Macao, which species do you believe are most deserving of protection? On the right column, place 1 if you think it is the most deserving of protection, 2 if it is the second, 3 for the third and 4 for the fourth.

Species		Rank	Species		Rank
1）	 Chinese White Dolphins	_____	3）	 Mangrove	_____
2）	 White Sea Eagles	_____	4）	 black-faced Spoonbill	_____

5. Please read the following statements and tell us your opinion on a scale of 5 (strongly agree) to 1 (strongly disagree). Please remember that there are no right or wrong answers to these questions. Please √ the column to enter your answer.

STATEMENT TO AGREE/DISAGREE ON…	5	4	3	2	1
a. The government should raise more funds to deal with environmental programs.					
b. There are more important environmental concerns than endangered species conservation.					
c. Poaching of wildlife species should be punishable by law.					
d. It is everyone's duty to ensure that plants and animals as we know them today will exist for mankind to enjoy in the future.					
e. Citizens should contribute to endangered species conservation by making cash donations to this cause.					
f. Endangered species are important even if I don't get to see or interact with them					
g. The government should raise taxes to pay for more endangered species protection.					
h. The government should invest in helping people before it spends money on endangered species.					

i. Households who earn more income should contribute more to endangered species conservation.					
j. Endangered species conservation should be a priority concern of the government.					

The following questions are about black-faced Spoonbills.

6. Have you ever seen a live black-faced Spoonbill? Yes ☐ No

7. The black-faced Spoonbill is a migratory bird. Yes ☐ No Don't know

8. Some communities could benefit from black-faced Spoonbill conservation, such as through ecotourism. Yes ☐ No Don't know

SECTION 3: A CONSERVATION PLAN FOR SPOONBILLS IN MACAO

We'll now provide you with some information about black-faced Spoonbills in Macao.

The black-faced Spoonbill (*see the picture on the right*) is a specious bird species in the world. In 1994, it was classified as endangered by IUCN- World Conservation Union "Red List". It also belongs to the second class of threatened birds in China according to the China Red Databook of Endangered Animals.

The known world population of black-faced Spoonbills had remained in a few hundreds only in the 1990s. With the increasing knowledge and awareness of people of the natural ecosystem, the number of black-faced Spoonbills around the world has increased. But the total world population was still only 1206 in 2004. The black-faced Spoonbill is still globally endangered due to its small known world population.

The black-faced Spoonbill is a migratory bird that breeds in the temperate region during summer and migrates south to subtropical and tropical regions in autumn and winter.

Macao is an important over-wintering destination for this bird, using the Seac Pai Wan wetlands between the islands of Taipa and Coloane (where 50 of the birds have been recorded in 2004), which support 4.15% of the Spoonbill world population. Due to the importance of this bird, Macao SAR Government declared the two areas (one is 15 ha and the other is 40 ha) as protected ecological zones.

Threats faced by black-faced Spoonbills in Macao

Although the government has declared two protected zones, the black-faced Spoonbills in Macao are still under serious threats.

Human activities such as wetland reclamation and construction near/in the habitat are the major threats to the current and future life of black-faced Spoonbills in Macao.

Now, some human activities like wetland development have greatly disturbed the black-faced Spoonbills resting in the Seac Pai Wan wetlands. Due to human activities, the birds often have to fly to the wetland on the southeast of the nearby airport to rest, or to the wetland on the west of the Lotus Flower Bridge to feed. When the wetland's calm has been restored, they will return to roost and forage there again. This has greatly limited the activities of the black-faced Spoonbills on the wetlands.

In the 2004-2005 winter, only 41 black-faced Spoonbills were recorded in Macao for over-wintering, a significant decrease from the previous year.

9. Did you know that black-faced Spoonbills are endangered species before?
   (1) Yes (2) No

A Conservation Plan for Black-faced Spoonbills in Macao

Due to the importance of protecting black-faced Spoonbills, some conservation measures have been taken in mainland China, Hong Kong, Taiwan and South Korea. Macao is an important over-wintering destination of black-faced Spoonbills. If their habitats in Macao could not be protected properly, their existence is endangered.

To reduce the risk of black-faced Spoonbill extinction and to ensure the long-term survival of this bird in Macao, a conservation program for black-faced Spoonbills in Macao will be implemented. This conservation program mainly aims at maintaining the wetlands that black-faced Spoonbills use, ensuring a favorable condition for the wintering population of the bird. Some actions to be undertaken for this program include:

1. Safeguard the site by restricting human activities in and near the wetlands during the over-wintering period of black-faced Spoonbills, which is from October to March, including restricting the construction of buildings on areas that are critical habitats;
2. Conduct species and habitat management such as clearance of vegetation and preservation of black-faced Spoonbill prey and other environmental variables they depend on; prohibit the hunting of black-faced Spoonbills; protect the water quality in the wetlands;
3. Conduct research program to monitor water quality, assess population members, monitor aspects of black-faced Spoonbill health and diseases and learn more about their behavior and habits;

4. Conduct education and training activities to improve the awareness of the local people to conserve black-faced Spoonbills and the professional skills of the the management group staff;
5. Promote regional cooperation to learn from the some successful experiences in managing and conserving black-faced Spoonbills in Hong Kong and neighboring areas.

According to experts, if this conservation program could be successfully implemented, this critical habitat that black-faced Spoonbills use would be properly conserved. The black-faced Spoonbill population in Macao is predicted to increase to 127 after 2008.

While the program contains many good ideas, implementing it would require money. So far, the program has not received any funding or carried out any activities. A number of international organizations do provide financial support to protect important endangered species. However, they usually require that counterpart funds be made available. In other words, people from the region must also contribute money to the protection effort. Therefore, the practical implementation of this program would require much more concerted efforts from all households in Macao.

Trust Fund for the Conservation Program

Suppose a trust fund and fund management committee for the conservation program for black-faced Spoonbills in Macao would be set up, to which all citizens could contribute. The fund could then request international organizations to provide the same amount of money or more, according to the money raised locally. The money raised by the fund would be ONLY used for the conservation activities mentioned earlier to protect black-faced Spoonbills in Macao.

Mandatory payment vehicle

Assume now we have a referendum for the setting up of the trust fund for the protection of black-faced Spoonbills in Macao. In this referendum, all households in Macao would be asked to contribute <bid level> every month as a surcharge on the household water bill for the next five years. If more than half of the people vote 'YES', then the referendum passes; each household in Macao pays <bid level> as a surcharge on household water bill every month for the next five years to the trust fund. The payment is a fixed amount and it doesn't change with the volume of water used. If more than half of the people vote 'NO', no one pays and no money is used for the conservation of black-faced Spoonbills in Macao.

Voluntary payment vehicle

The purpose of our survey is to find out if your household would be willing to contribute <bid level> every month as a surcharge on your household water bills for the next five years. The payment is a fixed amount and it doesn't change with the volume of electricity used. This money would go to the trust fund for the protection of black-faced Spoonbills in Macao.

The reason that the surcharge would end after five years is that it is expected that by that time enough money would have been raised to establish a trust fund. The income from this trust fund could be used by the Black-faced Spoonbill Conservation Program far into the future.

Here, I'd like to tell you some results of recent studies. People in hypothetical situation always give a higher willingness to pay value than people in real situation. We call this a 'hypothetical bias'. To make sure that we can get an accurate research result, we'd like to ask you to think carefully about your decision. If I were you, I would ask myself: if this were a real situation, if I said I would be willing to pay, I had to pay and that would reduce the money availabe to contribute to other issues or to buy things: do I really want to spend my money this way? If I really did, I would vote 'yes'; if I didn't, I would answer 'no'. In any case, I would like to ask you to answer the following questions just exactly as you would if you were really going to face the consequences of your answers.

10. Would you be willing to pay <bid level> every month to protect the black-faced Spoonbills in Macao?

    Remember that the charge would be added to your water bill every month for 5 years. The amount is fixed and doesn't change with the volume of water used. The money raised would go to the trust fund described above. Please √ your answer.

(1) Yes (2) No → [**Go to Q13**]

11. What was it that made you be willing to vote for the conservation program? *Check ONE most appropriate answer.*

a. The black-faced Spoonbill is an endangered species and should be protected.	Yes1
b. I believe the implementation of this conservation plan can contribute to the environmental protection in Macao.	Yes2
c. The implementation of this conservation plan can provide the future generations with a good living environment.	Yes3
e. The implementation of this conservation plan can contribute to the conservation of more endangered species.	Yes4
f. Others (please specify)	Yes5

12. How certain are you that you would actually vote this way (or pay this amount) if this referendum (or program) was really happening?

Please √ ONE NUMBER

1	2	3	4	5
Very uncertain				Very certain

→ [**Go to Q16**]

13. If NO, can you tell me why you would vote against the program? *Check ONE most appropriate answer*

a. I do not think the conservation of black-faced Spoonbills is worth doing.	No1
b. I cannot afford that amount.	No2
c. I do not believe the money that I will pay will actually be used for Spoonbill Conservation.	No3
d. I think it is the government's responsibility.	No4
e. I do not believe paying will achieve the target objective.	No5
f. I think that other species are more important than black-faced Spoonbills.	No6
g. Others (please specify)	No7

14. Is there any amount that you would be willing to contribute monthly to support the conservation program for black-faced Spoonbills in Macao?

(1) Yes (2) No → [**Go to Q16**]

15. If YES, what amount would this be? _____ MOP/month

16. How much do you believe that the implementation of the black-faced Spoonbill conservation program could contribute to conserve black-faced Spoonbills in Macao?

(1) Much

(2) Average

(3) Not at all

17. Considering both negative and positive aspects of developing wetlands by reclamation, do you agree with wetland development?

(1) Yes (2) No

18. When you decided on your vote, did you believe that the Macao Water Company would agree to collect the funds for this program?

(1) Yes → [**Go to Q20**]

(2) No

19. If no, why not? Please check the most appropriate answers.

☐ 1. The Macao Water Company will not do this for free—they will get a big part of the collection money to pay for their effort

☐ 2. The Macao Water Company is not bound by law to do this—I don't know what will make them agree to do this task.

☐ 3. Other reasons (please specify)

_____

20. When you decided on your vote, did you like the proposal to collect the people's contribution as a surcharge on your water bill, rather than, say an increase in other taxes?

(1) Yes → [**Go to Section 4**]

(2) No

21. If NO, why not? Please give your reasons: _____

_____

SECTION 4: SOCIOECONOMIC INFORMATION

Now, I would like to ask you some questions about you and your household. The questions may seem personal, but they are necessary because they help us analyze the results of this survey. Your responses will be kept ***completely confidential****. Please think carefully about each question and give your best answer.*

22. What is the main source of drinking and cooking water in the house?

Bottled water	DWTER1
Tap water	DWTER2
Both	DWTER3
Others (*please specify*)	DWTER(-95)

23. How much was your household's own water bill last month? _____MOP

24. Does your household own this house/apartment?

Own	HO1
Rent	HO2
Provided by government	HO3
Others (please specify)_____	HO (-95)

25. What is your age? _____years

26. Gender:

Male	_____	Gender
Female	_____	

27. Civil Status

Single	_____	Civstat
Married	_____	

28. Educational Attainment (highest level)

No formal schooling	_____	Educ
Elementary	_____	
High school	_____	
College	_____	
Master's or above	_____	

29. Including yourself, how many people are there in your household? _____ How many children are below 15 years old? _____ How many in your family, including yourself, is/are earning cash income? _____

30. Please indicate if your household owns the following. If so, how many?

Refrigerator		Asset1
Washing Machine		Asset2
Motorcycle		Asset3
Air conditioner		Asset4
Computer		Asset5
Car		Asset6

31. Please check the average monthly HOUSEHOLD income bracket where your household belongs (include the cash earnings of all family members who are working or gainfully employed, including yourself).

1. Below MOP 5000	CashY1	
2. MOP 5000-10,000	CashY2	
3. MOP 10,001-15,000	CashY3	
4. MOP 15,001-20,000	CashY4	
5. MOP 20,001-25,000	CashY5	
6. MOP 25,001-30,000	CashY6	
7. MOP 30,001-50,000	CashY7	
8. More than MOP 50,000	CashY8	

32. How would you classify the economic status of your household relative to others in Macao?

1. Much better than most people (rich)	ES1
2. Better than most people (relatively well off)	ES2
3. About average	ES3
4. Below average	ES4
5. Much worse than average	ES5
6. Don't know	ES(-98)

33. In the past year, has your household made donations to any charitable causes?

(1) Yes (2) No

34. In the past year, has your household made donations to any environmental organizations?

(1) Yes (2) No

35. Are you a member of any environmental organization?

(1) Yes (2) No

36. Do you have any pets in your household?

(1) Yes (2) No

37. Did you discuss the questions in this survey with other household members before you answered them?

(1) Yes (2) No → [**Go to Q40**]

38. If yes, which of the following best describes how your household answered the questions in this survey?

☐ 1. I discussed some of the questions with others, but the answers I gave represented my own opinions.
☐ 2. We discussed together how to answer the questions and gave our household's best judgment.
☐ 3. Others (please specify) _____

39. How much time do you think you spent discussing the questions with other members of your household?

☐ 1. ≤5 minutes
☐ 2. 6-15 minutes
☐ 3. 16-30 minutes
☐ 4. 31-60 minutes
☐ 5. > 60 minutes

40. Do you think your answers to the questions would have been different if you had not/had been able to discuss them with other members of your household?

(1) Yes (2) No

(If the respondent heard that other people got different bids from what he/she received and felt worried about that, the enumerator, when he/she comes back to pick up the questionnaire, will explain to the respondent that this is only for our research requirements to derive a demand curve.)

Thank you very much for answering this survey! If you have any concerns or opinions you would like to share concerning the questionnaire or black-faced Spoonbill conservation, please use the space provided below:

_____

_____

Please help us to fill in the following confirm form:

CONFORME FORM

This is to certify that I participated in the interview voluntarily and that I responded to the questions to the best of my knowledge. The interviewer would be welcome to come back should there be any further clarification in the future about my answers.

_____ _____

Signature of Respondent and Date Phone Number

Your time and effort are highly appreciated!

Invitation Letter

Dear Mr./Ms.

Some recent studies found that people in some situations are willing to pay different amounts for the same goods. To find out how Macao people respond to different settings, an experiment will be run. The experiment is financed by the Economy and Environment Program for Southeast Asia (EEPSEA) and is conducted by researchers from the University of Macau.

You are chosen to participate…

120 persons will participate in the experiment from the whole Macao residents. Twelve sessions, 10 participants for each, will be held. This implies that a small number of people will get together and answer the questions. We would therefore like to invite you to participate in one of these meetings that will take place at the University of Macau at:

Saturday, 15/10/2005	10:00 – 10:30 _____	11:00 - 11:30 _____
	14:00 – 14:30 _____	15:00 - 15:30 _____
	16:00 – 16:30 _____	17:00 - 17:30 _____
Sunday, 16/10/2005	10:00 – 10:30 _____	11:00 - 11:30 _____
	14:00 – 14:30 _____	15:00 - 15:30 _____
	16:00 – 16:30 _____	17:00 - 17:30 _____

The meeting will begin with a short introduction of the survey. We will then ask you to answer a number of questions. We will serve coffee, tea and cake. ***You will receive 100MOP at the end of the meeting.***

It is important that you answer…

But participation is voluntary. Your answers will be kept strictly confidential, and the results will be published in a way that no single person can be identified. We ask you to fill out the attached and give it to our enumerators when they come to pick up the questionnaire. If you have any questions or would like to know more about the survey, please contact Ms. Jin Jianjun at 3978526 or the enumerator.

With best regards,

Jin Jianjun

PhD Candidate of University of Macau

Your decision

I, _____ hereby confirm that I would like to participate in the meeting at _____(time), ____/08/2005(date) (Please mark your preferred time for the meeting).

In case we need to contact you, please provide your phone number below.

Thank you for confirming your participation in the meeting.

Address: _____ Telephone: _____

Appendix B. Scripts for Hypothetical and Real WTP Experiment in Macao

Good morning/afternoon. We would like to thank you very much for coming here. Your participation in this game is very important to our research on the public's willingness to pay for the black-faced Spoonbill conservation. The experiment you are going to participate in is about an auction of a t-shirt (*The interviewer shows the t-shirt to the group*).

The t-shirt you are going to auction is made of 100% cotton, with one black-faced Spoonbill print on it. The small picture showing triple E is the symbol of Economy and Environment Program for Southeast Asia, the sponsor of this research. The purpose of this auction is to see how much you would be willing to pay for this t-shirt. Any income got from this auction will be used for the conservation activities of black-faced Spoonbills in Macao.

Please be informed that the main purpose of this auction study is to raise the awareness of the public about the conservation of black-faced Spoonbills in Macao. We are not advertising t-shirts of any brand. These t-shirts are exclusively produced for this game only. They are not sold in the market. The game you are playing here is very helpful for us in understanding how people make decisions in different situations.

(*Pass a sample t-shirt around to give everyone the opportunity to physically inspect it).* Do you have any questions?...

Hand out the answer sheet…

For Group A:

Suppose you would be asked to participate in an auction for this t-shirt (hold it in front). Please let us know your if you are willing to pay for it by putting √ on "Would buy" or "Would not buy" at each price we provide in a table in your answer sheet. There are six prices, presented in six rows in the answer sheet. You will make six choices. For each price given, please put a √ on "Would buy" if you think you would buy it at the corresponding price, or place √ on "Would not buy" if you think you would not buy the t-shirt at that price.

Some recent studies found that people in hypothetical situation always give higher willingness to pay values than people in real situation. We call this a 'hypothetical bias'. To make sure that we can get an accurate research result, we'd like to ask you to think carefully about your decision and tell us the true amount that you are willing to pay for this t-shirt.

Table 1. Prices of the t-shirt that you are willing to pay

No	Price (USD)	Would buy	Would not buy
1	1.00	_____	_____
2	1.25	_____	_____
3	1.50	_____	_____

4	1.75	_____	_____
5	2.00	_____	_____
6	2.25	_____	_____

1. What's the maximum amount that you are willing to pay for this t-shirt? _____USD
2. If you would not buy this t-shirt at any price given above, please tell us your reasons:
    a. I don't like this t-shirt
    b. The price is too high
    c. I don't like auction activities
    d. Others, please specify:_____
3. How certain is your answer?
    a. Very certain
    b. Certain
    c. Average
    d. Not certain
    e. Not certain at all

When the respondents finish answering, the monitor will collect all the answer sheets. Then the respondents are paid for participating by an accounting (in private) set at the back of the room.

For Group B:

You are given a chance to bid for this t-shirt. In this game, you must honor your bid (i.e., real payment is involved). One of you will be randomly selected to draw one piece of paper from this jar. This jar contains six pieces of paper, each representing six prices. The prices vary from $1 to $2.25 (see the prices and corresponding random numbers in the table below). The amount of payment will be decided by the randomly chosen price.

For example, if the randomly drawn price is $1.50 and if you state that you would buy the t-shirt at **$1.50 or above**, you will get the t-shirt and pay **$1.50**. Those whose stated amount is lower than $1.50 don't have to pay. The random draw will ensure that each price will have one out of six chances of being chosen. Everyone pays the **SAME** amount of money indicated by the random drawn price.

Do you have any questions?

Hand out the answer sheet…

Now please let us know how much you are willing to pay for the t-shirt by putting √ on "Would buy" or "Would not buy" at each price given in the answer sheet. There are six prices, presented in six rows in the answer sheet. You will make six choices, each time specifying whether you are willing to buy the t-shirt at the given price. You may choose either "Would buy" or "Would not buy" in each of the six prices.

When you indicate your choice, please think over about your willingness to pay. Overbidding increases the likelihood that you will have to pay more for the good than

desired, while underbidding increases the chance that you will not get the opportunity to buy the good.

Do you have any questions?

Now please fill out the answer sheet.

Table 2. Prices of the t-shirt that you are willing to pay

No	Price (USD)	Would buy	Would not buy
1	1.00	_____	_____
2	1.25	_____	_____
3	1.50	_____	_____
4	1.75	_____	_____
5	2.00	_____	_____
6	2.25	_____	_____

1. What's the maximum amount that you are willing to pay for this t-shirt? _____USD
2. If you would not buy this t-shirt at any price given above, please tell us your reasons:
    a. I don't like this t-shirt
    b. The price is too high
    c. I don't like auction activities
    d. Others, please specify:_____
3. How certain is your answer?
    a. Very certain
    b. Certain
    c. Average
    d. Not certain
    e. Not certain at all

Once you have answered all the questions, please raise your hand and an assistant will approach you to collect your answer sheet.

(Collect the answer sheets. Randomly choose one ID number and ask the subject indicated by the ID number to draw a price from the jar. Announce the price chosen. Ask those who give bids higher than the chosen price to buy the t-shirt.)

Finally, the subjects are paid for participating and get the goods they have bought by an accounting (in private) set at the back of the room.